THE MONTHLY

# Review

Next Month You'll

Completed Plans

The Hall Of Platers' Contribu

To The WAR Effort

Official Organ of the American Electroplaters' Society for the Advancement of the Science of Electroplating

DECEMBER ✦ ✦ ✦ 1945

# Season's Greetings

## and
## A MESSAGE OF APPRECIATION

Christmas Season is here again, the first real peace-time Christmas we have had in years. To our many good friends we wish to express our deepest appreciation for their patronage and good will in the past.

This is a time for solemn contemplation of the blessings bestowed upon our nation, for, with the world at peace, it will be a real, gay, old-fashioned Merry Christmas. Therefore, with more than seasonal heartiness, we send this joyous greeting — a Very Merry Christmas and a Prosperous New Year to all!

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.

# PRECISE SURFACE PREPARATION

## by Oakite

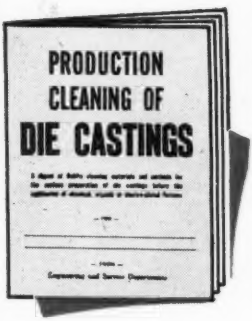
# INCREASES

Corrosion Resistance

Utility Life

Decorative Effect

**This fact-filled Oakite Digest gives complete details of cleaning procedures preliminary to applying organic or chemical finishes on all types of die castings . . . aluminum, zinc, magnesium, antimonial lead, brass, bronze, lead, tin alloys, Brittania metal and white metal.**




**The Oakite surface preparation techniques described herein combine low cost with high speed and effectiveness . . . give you the advantages of thorough cleaning with complete safety and free rinsing. The usefully presented data contained in this Digest discusses a wide range of variable conditions . . . describes material and technique best suited to meet your particular requirements.**

**Send for your copy of this informative Digest TODAY! It's FREE for the asking.**

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*Technical Service Representatives Located in All Principal Cities of the United States and Canada*

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U. S. Patent 2,242,106

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A Tough Synthetic Enamel being Disintegrated and Lifted Away from Base Aluminum

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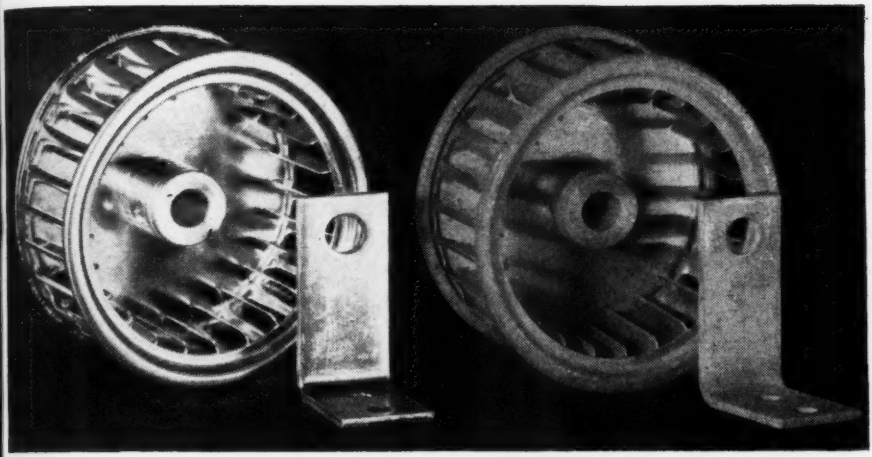
Chemical Products and Electroplating Equipment



# EVEN A SQUIRREL WOULD CHOOSE

# THE *Shiny one!*

## AND IT WON'T FINGER-MARK DURING ASSEMBLY!

No doubt about it, these squirrel cage fan rotors tell the Luster-on* story at its best. Here is an example of small parts extensively used in the electric, electronic and radio industries. Expense and time are important here — yet appearance and surface protection must not be ignored.

Zinc plating alone gives the dark, stained, finger-marked, unattractive product on the right, readily susceptible to white corrosion. But a simple, inexpensive cold-dip treatment with Luster-on* works miracles on that same zinc plate.

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Investigate Luster-on* today for your radio and electrical parts, for chassis assemblies, for metal stampings — for better business!

*Patent applied for

**THE *Chemical* CORPORATION**

**54 Waltham Ave., Springfield 9, Mass.**

**THE CHEMICAL CORPORATION**
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*Address*.....

*The Monthly Review, December*

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THE MONTHLY

# Review

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**Subscription: $3.00 a year**
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Entered as second class matter September 14, 1945, at the post office at Paterson, N. J., under Act of August 24, 1912.

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Remember — CORRONIZING. It can save you and millions of other Americans a huge tax bill now needlessly paid to the enemy rust.

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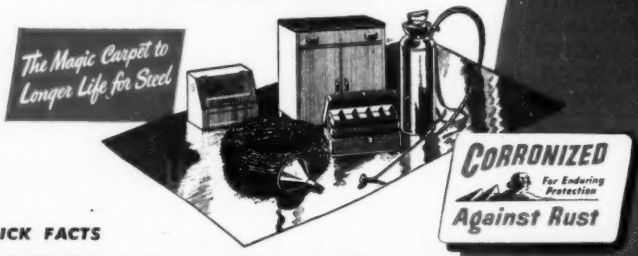


**QUICK FACTS**

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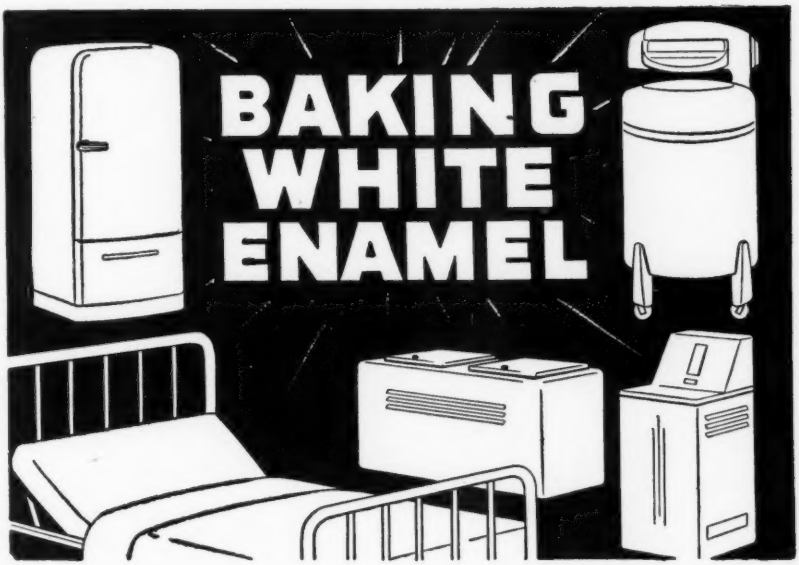


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## ABRASIVE BELT

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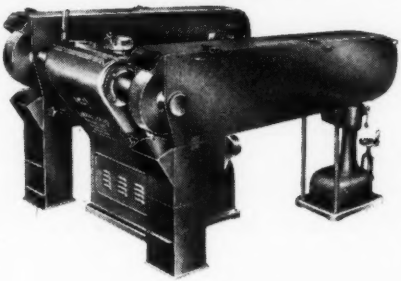

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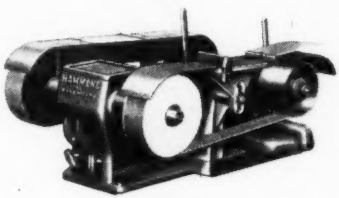

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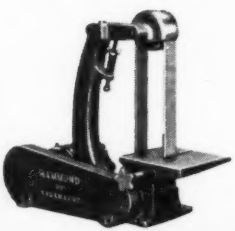
The Hammond No. 5 and its various combinations—for faster, better finishing, grinding, deburring, brushing, polishing and buffing. Uses wheels or abrasive belts as required . . . Flat surfaces are done easily on the horizontal belt platen.



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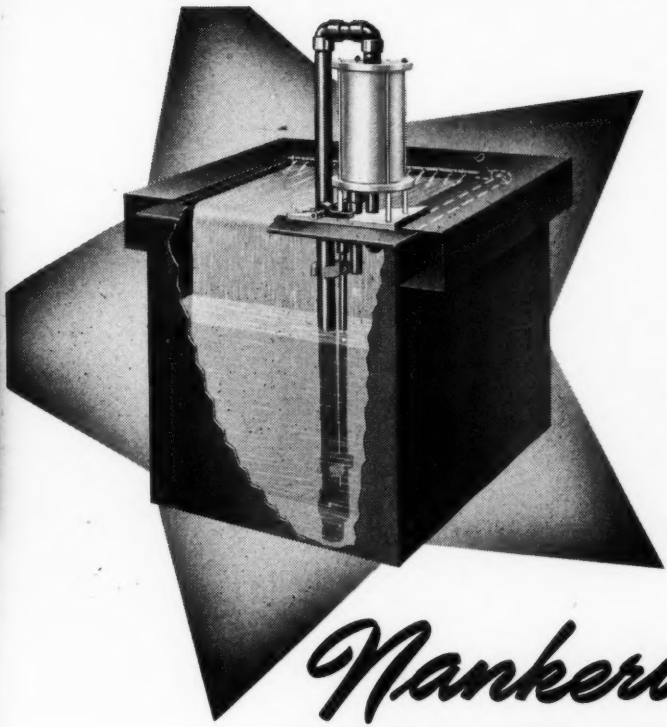

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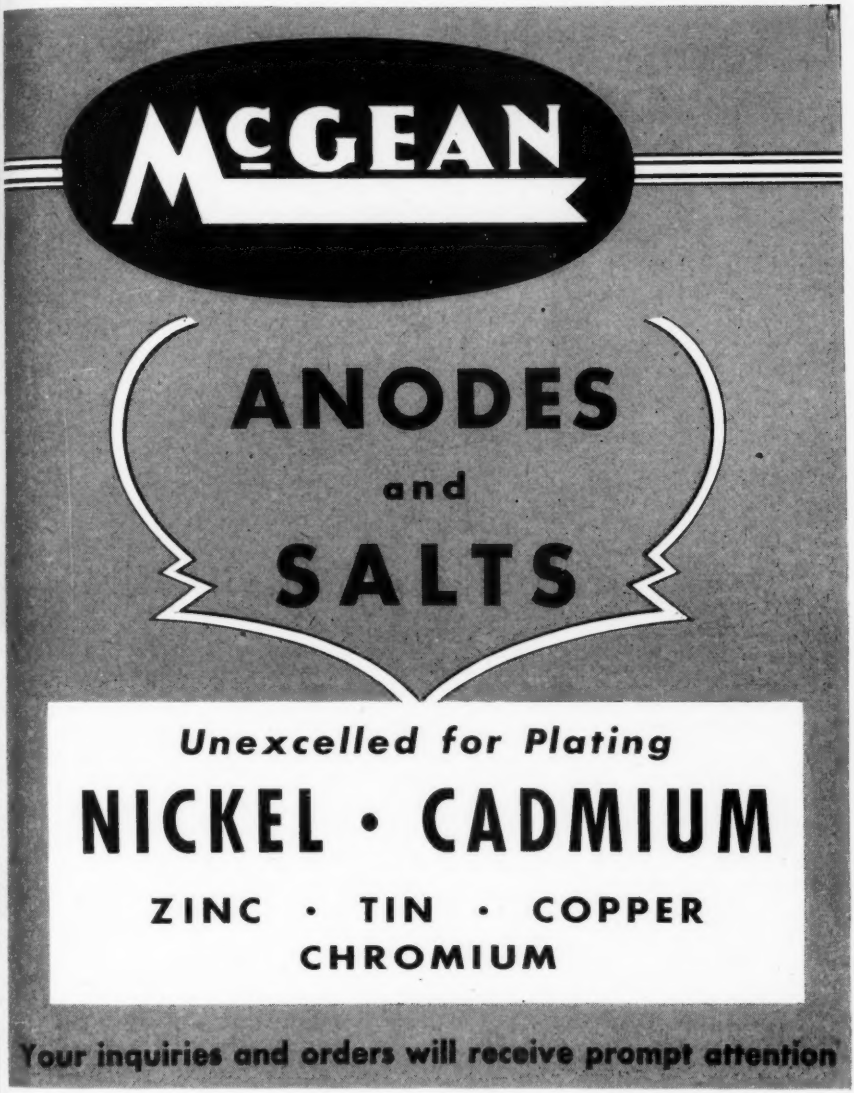


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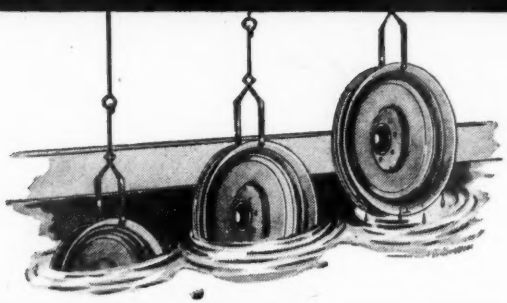
CLEVELAND 15, OHIO

IRIDITE

# PERMITS USE OF ZINC PLATE IN PLACE OF MORE COSTLY MATERIALS



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1 ***As a final finish,*** Iridite is available in a variety of attractive colors.

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3 ***To reduce costs,*** consider using galvanized, plus Iridite, in place of more expensive metals.

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Gentlemen: Please send me a free panel of Iridite-treated zinc plate for laboratory testing and full information and operating details.

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## PUBLICATION DATE

For some months the REVIEW has been mailed no earlier than the 19th of the month. With the cooperation of the printer, we expect to mail the REVIEW at an earlier date, while ultimately establishing the 10th of the month for regular mailing. To accomplish this, it is necessary to establish an earlier deadline for the receipt of manuscripts, or other material, at the Secretary's office. At the present time, all material must be received not later than the 18th of the month prior to the month in which the issue is to be published.

Members, Branch Secretaries and Authors of manuscripts are urged to note the change in the deadline date for receipt of material as they appear in announcements during the next few months, while this change is being accomplished.

A. K. GRAHAM

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# Well Balanced Educational Program Planned For Pittsburgh Convention

RECENTLY announced, the tentative Educational Program for the 33rd National Convention to be held in Pittsburgh, June 17-20, 1946 seems to have been exceptionally well planned. Presentation and discussion of the work of the A.E.S. Research Committee has been alloted one and one-half sessions; papers on Organic Coatings and Finishes one session; Strip Plating one session; Miscellaneous Plating subjects one and one-half sessions. There is also a possibility that a sixth educational session may be scheduled and, as in the past, plant inspection trips will round out the program.

The sessions devoted to the activities of the Research Committee, in addition to presenting technical developments, will also permit members to become acquainted with the personnel engaged on the various Research Projects.

The session on Organic Coatings and Finishes will be devoted to the advances in the development of tank linings, corrosion resistant equipment, rack coatings, and similar materials. It will also cover developments in protective and decorative organic finishes.

Inclusion of a session on Strip Plating has a two-fold objective: first, to cover various technical aspects of this relatively new subject, and second, to guide the interest in this purely electroplating development to within the scope of the A.E.S. It is hoped that increased interest and membership will be attracted to the A.E.S. because of this logical activity.

The Miscellaneous Session will be devoted to a variety of plating topics including plating on aluminum alloys, treatments for magnesium alloys, phosphate coatings, electropolishing, copper plating, etc.

As can be seen from this tentative schedule, the Committee in charge has been very active in lining up a well rounded educational program to cover an extremely wide range of topics and there is the promise that both the quality and authoritative nature of papers to be presented will set a new high. It, therefore, behooves members to attend this first Convention in two years which promises to yield exceptionally profitable, educational and practical, work-a-day, information. Start your plans now to be at the 1946 Convention!

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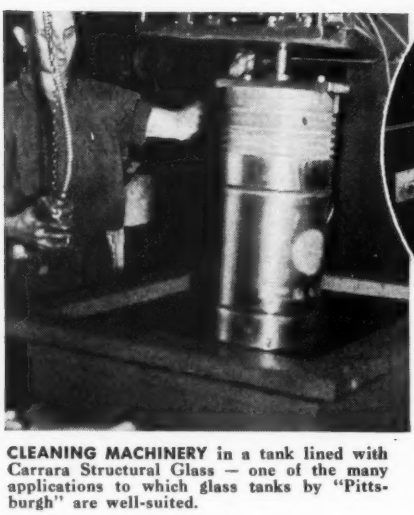

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# PRICING JOB ELECTROPLATING

By PAUL E. MILLER

Miller Electroplating, Inc., Evansville, Ind.

THIS article on a method of pricing electroplating is based on the author's experience in operating a typical job plating shop for a period of well over twenty-five years. It includes the plating with all kinds of metal, from the precious metals on down the scale to the most common, including, during the last fifteen years, industrial or "hard" chromium. The plant employs a crew varying from 8 up to 25 when needs demand.

In the old days before electroplating could be classed as a science, the successful operator without technical knowledge depended almost entirely upon his own experience to turn out a good product. The selling price of the product was arrived at with a similar technique: all that the traffic would bear, or a price below the competitive figure, without any knowledge as to what the job actually cost. Today, such methods are as obsolete as the old hit and miss method of plating and certainly no O.P.A. Board would smile on such a pricing of the product.

In examining a few of the jobs we have today we find: Customer "A" comes in with a box of gadgets to be barrel plated in cadmium. The pieces are fairly bulky, made of clean, cold rolled steel, and .0003 in. plate is desired. Next week he changes his mind and wants .0005 in. plate. What would be the proper additional amount to charge?

The next day he sends in the same box, but this time it is filled with small parts that pack closely and are made of a light gauge hot rolled stock. The parts are greasy and covered with the fire scale. He ordinarily wants .0003 in. cadmium plate, but when the pieces are to be subjected to extreme exposure conditions they must have a .0006 in. deposit.

Customer "B" is a manufacturer of radio or communication equipment. In the past a number of his parts were cadmium or dull nickel plated, but now he demands a silver plate as heavy as on the finest table ware. How much are we going to charge him for his job? His requirements are also very irregular: one day he sends 50,000 pieces, and the next week 150 pieces. Shall the same rate per hundred prevail?

A job that previously would have been plated in a barrel nests sufficiently that it is not practical to plate to rigid specifications by this method. The pieces must be racked or, in some instances, wired and still plated. Here again a fair charge is the problem.

Over in the industrial chrome department there are also problems. Here comes a large shaft 6 or 7 feet long and weighing 800 or 900 lbs., on which it is required to deposit .002 in. chromium on a bearing surface of only 5 or 6 in. in length. In the next tank is a die or plastic moulding cavity that is worth several thousand dollars, and yet only requires a thin deposit on a small area. The next tank contains a piston rod of plain design and ordinary material, worth $10.00 or $12.00 at the most, but the order calls for the entire surface to be plated with a deposit of .020 in. chromium.

The author believes that every job must stand on its own. If we have to gamble to make a living, then it is time to close the doors and go out and watch the ponies run, where we can at least have some fun out of it. A long profit on the easy job and a short profit, if any, on the other, do not balance out properly when the proportion of the two types vary to any degree.

The answers to the foregoing questions are simple if one knows two or three factors in the shop. Having a selling price based on the real cost that stands up under scrutiny of a cost analyst might save the embarrassment of trying to explain to an indignant customer an apparent overcharge.

The cost of polishing and buffing is rather simple; it comprises the costs of the labor on an article plus the material used plus the overhead. The overhead can be figured against this operation in proportion to its total of the business volume and space required.

Consider then only the cost of plating. In our method of pricing, we use two bases

to arrive at the selling price. The first is the amount of direct labor actually required to plate the article. This starts with the receipt of the piece from the polisher or wherever the starting point in the plating department is. The time for racking or wiring, cleaning, degreasing, and any other necessary work prior to introduction to the plating bath is tabulated. The time in the bath is forgotten for the moment, but that required for rinsing, drying, etc., and forwarding to inspection after plating is tabulated. Adding all together gives us the total direct time, which is the first fact that we must know.

Next, we must know the amount of electrical energy used in the plating bath, and of course the kind of bath that was used. The ideal method is to use the ampere-hour meter, but in its absence substantially the same results can be obtained by multiplying the number of amperes drawn by the time in hours or fraction of an hour that the work was plated.

For example, if the load on the ammeter is 250 amperes, and it was necessary to plate the run one hour and fifteen minutes to get the proper thickness of plate, the number of ampere-hours would be 250x 1.25 or 312.5.

We now have our two bases: the actual amount of labor required and the ampere-hours necessary. Each of these items are multiplied by a different factor, and the totals added together represent the total cost. To this is added the desired profit.

In arriving at the factors, several items must be taken into consideration. First, the direct time or time actually worked on the job is by no means the total time. From our experience, we have found that a great deal of time charged to the plating department does not actually go into the task of taking work in and out of the tanks. There is time for starting and stopping, supervision, solution analysis and corrections, cleaning rods and connections, tending fires for steam generation or heating, rest periods, waiting for work or tank space, and many other interruptions in the smooth flow of productive time. If the average hourly rate, including that of the foreman, is $1.20 per hour, the rate for the labor of actually taking work in and out of tank will be more than likely $1.80 per hour; and to this must be added overhead, which for convenience in this case, we will say is $1.20 per hour. Here then, we have a total of $3.00 per hour or 5c per minute which is the factor for arriving at the total labor cost.

For the selling price of the ampere-hour, we have found from experience that in the case of cadmium at 95c per pound (and these figures can be readily checked from any of the available tables in our plating guides) the cost of cadmium metal, cyanide, and solution upkeep will figure very close to ½c per ampere-hour. Alternating current which cost 5c per Kwh, after conversion to 12 volt direct current with 75% efficiency, will cost .8 mills per ampere-hour. The total direct cost of deposited cadmium would then be $0.0058 per ampere-hour. Adding the proper amount for overhead, one may for example reach a figure of $.01 per ampere-hour as the total cost for the deposition of cadmium metal.

Silver at 72c per troy ounce costs approximately 13c per ampere-hour to deposit without overhead. The various factors for other metals can be estimated or arrived at from experience.

One may now assume that these are the two desired factors:

A total direct labor cost rate of $3.00 per hour.

A total cadmium cost rate of 1c per ampere-hour.

With these two factors in mind we will figure the first problem with Customer "A". The parts were bulky, a barrel load weighed only 50 lbs., and totaled 600 pcs. The cleaning did not require much more than degreasing the lot in a basket, up and down in the cleaner a few times, rinsing, acid dipping, rinsing again and putting into the plating barrel. This took 12 minutes, and the after the plating it took another 8 minutes to unload the plating barrel, rinse and properly dry the work and deliver it to the inspection. A total of 20 minutes sufficed for actual handling of the work.

The ampere-hour meter registered 150 ampere-hours as necessary to deposit the .0003 in. plate.

We therefore have:

| | |
|---|---|
| 20 minutes @ $3.00 per hour | $1.00 |
| 150 ampere-hour @ 1c | 1.50 |
| Total Cost | $2.50 |

This figure can be divided by the weight of 50 lbs. to give $.05 per pound, or by the total number of pieces, which was 600, to give a cost of $.0041 each.

If a thickness of deposit of .0005 in. was required instead of the original thickness of .0003 in. the labor charge would remain the same and the ampere-hour charge would increase in proportion to the thickness. Hence:

| | |
|---|---|
| 20 min. @ $3.00 per hour | $1.00 |
| 250 ampere-hour @ 1c | 2.50 |
| Total Cost | $3.50 |

or $0.07 per pound or $0.00583 each.

The box that Customer "A" sent in the next day was loaded with 20,000 small, greasy and scaly parts, weighing 100 lbs. The extra work in cleaning, de-scaling, drying, etc., ran the total time up to 35 minutes, and because of increased surface involved, it required 475 ampere-hour to deposit the necessary plate. Therefore:

| | |
|---|---|
| 35 min. @ $3.00 per hour | $1.75 |
| 475 ampere-hour @ 1c | 4.75 |
| Total Cost | $6.50 |

or $0.065 per lb. or $0.000325 each.

Pricing Customer "B's" work in cadmium is similar. However, when he wants silver instead of cadmium, the cleaning and handling rate remains the same, but the ampere-hour rate changes from 1c to approximately 20c to compensate for the difference in the cost of the materials used.

The job that couldn't be plated in a barrel, but had to be racked or wired, suffered a big increase in labor costs, but on the other hand did not take any more ampere hours to plate than if it were handled in a barrel.

To compensate for the difference in handling full barrel loads and the occasional small lots that come in, we have a minimum charge for the use of any of our plating barrels, based on the time it is used, regardless of the fact that the cost based on the ampere-hour consumed does not equal the minimum charge.

The large shaft that requires .002 in. industrial chromium might figure out like this: Time required to insulate or to stop off, to rack, clean and put into the tank together with time for removal and clean-up might be 2½ hours. The amperage required might be 144 amperes for 2 hours. The cost for labor and chromium are therefore:

| | |
|---|---|
| 2½ hours @ $3.00 | $7.50 |
| 288 ampere-hours @ .6c | 1.73 |
| Total Cost | $9.23 |

The expensive plastic cavity might figure out like this: 4 hours to prepare special conforming anodes and insulating, and 10 amperes required during 1½ hours:

| | |
|---|---|
| 4 hours @ $3.00 | $12.00 |
| 1½ hrs. @ minimum tank charge of 60c per hour | .90 |
| Total Cost | $12.90 |

The $10.00 or $12.00 piston rod might come out this way:

| | |
|---|---|
| ¼ hour @ $3.00 | $ .75 |
| 450 amperes for 20 hours @ .6c per ampere-hour | 54.00 |
| Total Cost | $54.75 |

We believe that the above examples provide a fairly good idea of the operation of this system. It will be noted that in barrel plating there is no relationship between weight and cost of plating, because none exists. The customer pays for what he receives, a small charge for handling clean work, or a higher charge for handling dirty work, plus a definite amount for plating based on his thickness requirements. We are properly compensated for the job that involves expensive racking or insulating problems and are paid fairly for the deposit thickness.

Some, no doubt, will not agree with the precise cost figures as set forth, but that is beside the point. They are, of course, not our exact cost figures, and others may elect to figure some items differently.

To the cost as outlined above, one certainly is entitled to a fair profit and should add that to arrive at the selling price.

This method should be accepted only as one would accept any other tool, for that is what it is, a tool. Like in the use of any other tool, its handling will become simpler only through the experience gained in its use. It may appear complicated at first, but after understanding and application we have found it extremely simple, accurate and consistent. It enables us to arrive at what we believe to be a fair, just selling price.

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POLISHING ROOM Accessories
CHECK LIST
☐ Tube Polishing Machines
☐ End Chucks
☐ End Plate Chucks
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☐ Balance Weights
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# HAZARDOUS PLATING CHEMICALS

## From a Report Prepared by the Committee on Hazardous Chemicals and Explosives of the National Fire Protection Association in Co-operation with the American Chemical Society*

**Flammable Limits and Explosive Range.** In case of most flammable liquids there is a minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition. There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur. These limit mixtures of vapor or gas with air, which if ignited will just propagate flame, are known as the "lower and higher flammable or explosive limits," and are usually expressed in terms of percentage by volume of gas or vapor in air. These limits are also commonly referred to as the "low limit of flammability" and the "upper limit of flammability."

The difference between the lower and higher flammable or explosive limits, expressed in terms of percentage of vapor or gas in air by volume, is known as the "explosive range," also often referred to as the "flammable range." In general, the upper limit is higher and the low limit lower—i.e., the range is widened—for upward than for downward or horizontal propagation of flame.

**Ignition Temperature.** By "ignition temperature" of a vapor or gas is here meant the lowest temperature (minimum ignition temperature) to which any part of a flammable gas or vapor-air mixture must be raised by application of heat to cause combustion that will propagate itself.

**Propagation of Flame.** By "propagation of flame" is here meant the spread of flame from layer to layer independently of the source of ignition. A gas or vapor in admixture with air in proportions below the lower limit of flammability may burn at the source of ignition—that is, in the zone immediately surrounding the source of ignition—without propagating (spreading) away from the source of ignition.

**Flash Point.** By "flash point" of a liquid is here meant the minimum temperature at which a flammable mixture is formed by the vapor of the liquid with the surrounding air.

**Oxygen Breathing Equipment or Helmets.** The use of oxygen helmets (oxygen breathing equipment) or gas masks is recommended in several places in the table on entering atmosphere containing gases dangerous to life. In cases where oxygen breathing equipment is not available, a hose mask with a positive air blower may be substituted. The radius of action is, however, limited by the length of the hose.

**Oxidizing Materials.** By "oxidizing materials" is here meant the following common chemicals, which react with the evolution of heat or explosively with many substances: chlorates, perchlorates, bromates, peroxides, nitric acid, nitrates, nitrites, permanganates, bromine, chlorine, and iodine.

**Explosives.** The purpose in listing an explosive substance in the table is simply to indicate that it is considered to be subject to established explosives restrictions.

By "explosives restrictions" is here meant established safety requirements and regulations relating to the transportation, handling, and storage of explosives, information on which is included in publications by the U. S. Bureau of Mines (mining explosives), Institute of Makers of Explosives (commercial explosives), Bureau of Explosives of the American Railway Association, Interstate Commerce Commission (transportation of explosives), and the War Department (military explosives and ammunition)—see "Ordnance Safety Manual (No. 7224)." Laws for the enforcement of such regulations have been enacted in many States.

*Reproduced by kind permission from Chem. & Eng. News 23, 1248 (1945).

## Table of Common Hazardous Chemicals (Continued)

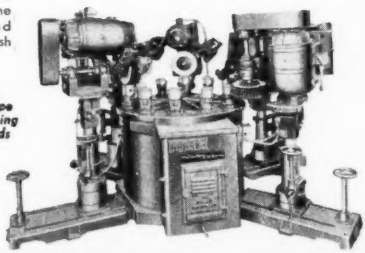
| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| Acetic acid (glacial) | Glass carboys and barrels | Dangerous in contact with chromic acid, sodium peroxide, or nitric acid; yields moderately flammable vapors above flash point 104° F. | May cause painful burns of skin | Safeguard against mechanical injury. Isolate from oxidizing materials as noted under Fire Hazard. | Extinguishing agent, water | Expands on solidification and may burst container unless kept at a temperature above 16° C. (60.8° F.) |
| Aluminum dust | Barrels or boxes | Forms flammable and explosive mixtures with air | | Keep in dry place. In case of fire do not use water; it may cause an explosion | Smother with sand, ashes, or rock dust. Do not use water, which may cause explosion | |
| Bleaching powder, calcium hypochlorite, chlorinated lime, chloride of lime (incorrect name) | Air-tight tin containers, wooden barrels, and steel drums | Not combustible but evolves chlorine and at higher temperatures oxygen. With acids or moisture evolves chlorine freely at ordinary temperatures. See chlorine | Corrosive. Irritating to skin, eyes, and lungs. See chlorine | Store in cool, dry, well-ventilated place away from combustibles. See chlorine. Rupture of drums containing bleaching powder, particularly if the chlorine content is high, may result from exposure to heat | Fires where compound is present may be fought with water, preferably spray. Protect eyes and skin, using gas mask of type approved by Bureau of Mines | Encountered in paper, textile, disinfectant, and alkali industries; also where water-purification processes are employed |
| Carbon disulfide | Small glass, earthenware, or metal containers packed in outside barrels or boxes (See I.C.C. Regulations). Steel drums, steel tank cars | Highly volatile liquid with offensive odor, giving off even at comparatively low temperatures vapors which form with air flammable and explosive mixtures. Flash point —30° C. (—22° F.) *(11)*. Flammable range 1 to 50% *(1)* (upward propagation). Ignition temperature is dangerously low, about 100° to 106°C. *(11)* (212° to 223° F.). It is endothermic, and vapor may be ignited by heavy blow. Vapors are heavier than air | Toxic. 3200 to 3850 parts of vapor per million (0.32 to 0.385% by volume) may cause dangerous illness in 0.5 to 1 hour *(5)*. Direct contact with skin should be avoided. Products of combustion contain sulfur dioxide, which in concentrations of 0.2% by volume in air may cause serious injury in 0.5 hour or less *(12)*. Often poisonous carbon monoxide is present in products of combustion | Isolate and safeguard containers against mechanical injury and metallic blows, and keep in unheated compartment away from sunlight and any source of ignition, including electric lighting fixtures and other electrical equipment. Storage tanks should be constructed over concrete basins containing water, and carbon disulfide kept blanketed with water or inert gas at all times | Heavier than water (sp. gr. 1.29) and sparingly soluble in it. Use sand, carbon dioxide, or other inert gas as extinguishing agents. Cooling and blanketing action of water may be utilized in case of fires in metal containers or tanks. Total-flooding carbon dioxide systems may be employed for protection in storage rooms. Foam not effective. Do not use carbon tetrachloride. Use of gas masks or oxygen helmets of type ap- | Carbon disulfide should never be transferred by means of air. Use inert gas, water, or pump. Use a wood measuring stick for measuring contents of storage tanks or tank cars. Tank cars when being loaded or unloaded should be well grounded. Do not dispose of carbon disulfide by pouring it on the ground. Provide a safe place for burning it. |

# FOR *Automatic* POLISHING AND BUFFING

## OUT THE WINDOW

–That pirate of profits– High Costs– makes a dash for the nearest exit when a Packer-Matic takes over. For here is a machine that reduces the hand work of polishing and buffing to the decimal point. Production goes up, costs go down and that elusive thing called "Profit" returns to the ledger.

There's a Packer-Matic for all shapes, metals and finishes. Write for factory time study- send part and finish desired.

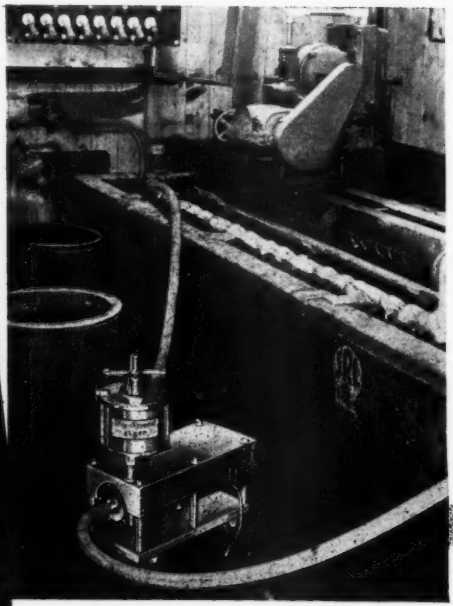


*No. 4-S Indexing Type With Oscillating Wheel Heads*

# *Packer-Matic*

THE PACKER MACHINE CO., MERIDEN, CONN., U. S. A.

# The FILTER that Plating Shop Men Are Buying... ...ON ITS REPUTATION



Note contrasting sizes of Alsop Filter and tank. This compact filter can handle a lot of solution.

YOU don't have to be sold on the necessity of operating the plating bath with a clean solution. It's a "must" for any shop where the objective is high quality work at the lowest possible cost.

Investigate the merits of the ALSOP "Sealed-Disc" Filter for this work. Each disc is a separate filtering element in itself, thus providing exceptionally large filter area and high capacity. High efficiency in removing solid impurities results from the graded density of the packed fibers. The layers graduate from loose-packed to close-packed. No filter aid is necessary. The filter is easily cleaned with no loss of solution.

The ALSOP "Sealed-Disc" Filter comes in many sizes, portable or stationary. In writing for information give your bath cleaning requirements. We'll be glad to recommend the proper type and size.

**ALSOP** *Engineering Corp.*

35 GRAND STREET

MILLDALE, CONNECTICUT

Table of Common Hazardous Chemicals (Continued)

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| | | (vapor density 2.62) and may travel considerable distance to source of ignition and flash back. More hazardous than gasoline | | | proved for purpose by U. S. Bureau of Mines recommended | |
| Charcoal (wood) | Boxes, barrels, bags, or bulk | Spontaneously ignitable when freshly calcined and exposed to air, or when wet; hazardous when freshly ground and tightly packed | Danger from carbon monoxide poisoning during burning unless adequate ventilation is provided | Isolate; prevent dust accumulations; ventilate well; make daily inspections | Use water, completely extinguishing fire, after which storage pile should be moved | |
| Chlorine | Steel cylinders and tank cars | Not combustile in air but reacts chemically with many common substances and may cause fire or explosion when in contact with them. See remarks under Storage | Corrosive. Irritating to eyes and mucous membrane. Toxic, 0.004 to 0.006% by volume in air causes dangerous illness in 0.5 to 1 hour *(6)*. | Isolate from turpentine, ether, ammonia gas, illuminating gas, hydrocarbons, hydrogen, and finely divided metals. Safeguard against mechanical injury of containers | Use gas masks on entering atmospheres containing chlorine gas. If, however, concentration is high, or there is doubt as to degree of concentration, use oxygen helmet of type approved for such use by U. S. Bureau of Mines | Dangerous to neutralize chlorine in a room with ammonia |
| Chromium trioxide or chromium anhydride, $CrO_3$ (often called "chromic acid") | Iron drums and glass bottles | Oxidizing material; will ignite on contact with acetic acid and alcohol. Chars organic material such as wood, sawdust, paper, or cotton, and may cause ignition. Combustible material in presence of chromium trioxide when ignited burns with great intensity. May cause explosion in fire | Irritating to skin. Poisonous | Isolate | Use water, completely extinguishing fire, after which storage pile should be removed | Used in chromium plating, in electric batteries, and in photography |
| Formic acid | Barrels and carboys | Flammable; gives off flammable vapors which may form explosive mixtures with air | Corrosive; has caustic effect on the skin | Safeguard against mechanical injury | | |

## Table of Common Hazardous Chemicals (Continued)

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| Hydrochloric acid (muriatic acid) | Tank cars (rubber-lined), carboys, and glass bottles | Not combustible (in air) but if allowed to come in contact with common metals hydrogen is evolved, which may form explosive mixtures with air | Aqueous solution is corrosive, irritating, and poisonous. Fumes corrosive and irritating to mucous membranes | Safeguard containers against mechanical injury. Keep away from oxidizing agents, particularly nitric acid and chlorates. Avoid contact by leakage or otherwise with all common metals | Use water or chemically basic substances such as soda ash or slaked lime | |
| Hydrocyanic acid (prussic acid) | Cylinders, or when completely absorbed in inert material in metal cans with outside wooden boxes | Forms flammable and explosive mixtures with air. Explosive range 6 *(13)* to about 40% by volume (horizontal propagation) | Poisonous. Few breaths may cause unconsciousness and death. Avoid contact with skin. | Isolate. Keep away from any source of heat. Safeguard containers against mechanical injury | Gas is slightly lighter than air. Soluble in water. Water is best extinguisher. When entering premises where used or stored during fire, use oxygen helmet or gas mask equipped with canister of type approved by Bureau of Mines for hydrocyanic acid | Concentrations of gas ordinarily employed for fumigation (1% or less) are considerably below the lower limit of flammability (6% by volume). Some methods of fumigation, however, are employed which temporarily yield flammable mixtures even though final concentration is low |
| Hydrofluoric acid (HF) | Aqueous solution in lead carboys and wax or gutta percha bottles | Colorless, volatile liquid. Not combustible but reacts with glass and most substances, platinum being an exception. Aqueous solution also attacks glass and several metals | Acid and its vapors highly toxic and irritating to skin, eyes, and respiratory tract. Fumes produced by contact with ammonia and many metals poisonous. May be neutralized with chalk. Bicarbonate of soda solution may be immediately applied to burns as first-aid and used as gargle | Isolate. Ventilate. Safeguard against mechanical injury | Use water in case of fires involving hydrofluoric acid. Use oxygen helmet of type approved for such use by U. S. Bureau of Mines on entering atmospheres known to contain hydrofluoric acid vapors. | Encountered in glass works and chemical laboratories. Used to remove sand from castings and in manufacture of filter paper. Vapors have been known to cause serious corrosion of sprinkler piping and heads |
| Hydrofluosilicic acid | Lead carboys, hard rubber or paraffin bottles | None | Corrosive | Safeguard against mechanical injury | | |
| Hydrogen peroxide (40%) | Glass carboys, aluminum drums, aluminum | Oxidizing liquid. May cause ignition of | Prolonged exposure to vapor irritating to | Store in cool place in ventilated contain- | Use water | |



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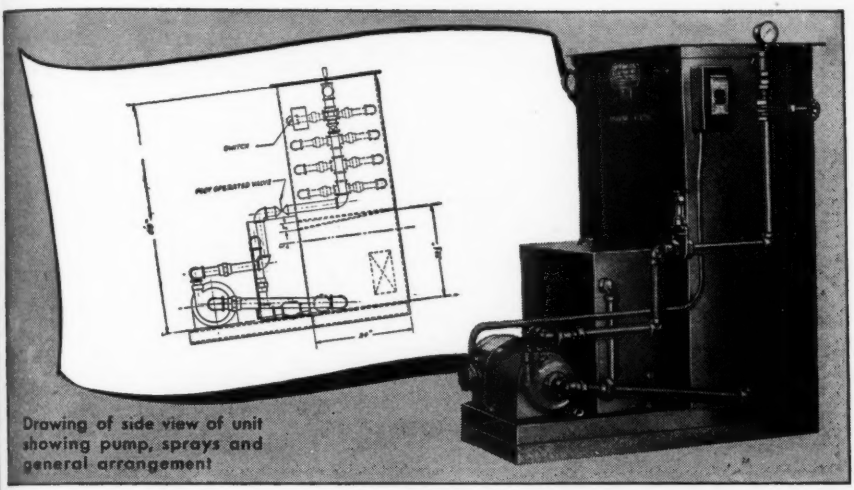

Drawing of side view of unit showing pump, sprays and general arrangement

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These compact units, which come equipped with pump and sprays, can be used individually, or they can be used in a series to handle a flow of related operations, such as—

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RINSE → DRY

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These machines, which are exceedingly low in operating costs, are ideal for use before, or after, plating, or before painting. Racks may remain stationary, or they may be moved thru the spray range automatically.

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**Table of Common Hazardous Chemicals (Continued)**

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| by weight) | num tank cars (all containers must be vented) | combustible material if left standing in contact with it may decompose violently if contaminated with iron, copper, chromium, and most metals or their salts | eyes and lungs. Causes skin irritation. Use goggles to protect eyes from splash | ers remote from combustible material and catalytic metals such as iron, copper, chromium | | |
| Hydrogen sulfide (sulfuretted hydrogen) | Steel cylinders | Flammable gas forms flammable and explosive mixture with air or oxygen. Explosive range in air (upward propagation) 4.3 (low limit) to 46 *(1)*. Heavier than air. Specific gravity 1.19 (air = 1). Ignition temperature 346 - 379° C. (655 - 714° F.) *(6)* | Toxic 0.05 to 0.07% by volume in air causes dangerous illness in 0.5 to 1 hour *(6)*. Should be used under hoods in chemical laboratories to avoid danger of breathing dangerous concentrations | Store in ventilated place away from fuming nitric acid and oxidizing materials | Use gas masks in entering atmospheres containing hydrogen sulfide. If, however, concentration is high, use oxygen helmet of type approved for such use by U. S. Bureau of Mines | Encountered in chemical laboratories, metallurgical and smelting works, gas works, sewers |
| Magnesium | Shavings or powder in tightly closed metal or metal-lined containers. Ingots and bars in ordinary boxes | Combustible, particularly in form of powder, shavings, or thin sheets. When powder is disseminated in air, explodes by spark. In finely-divided form liberates hydrogen in contact with water. In massive form (ingots or blocks) comparatively difficult to ignite | Serious under fire conditions. Danger of explosions and from flying particles. Do not attempt to smother unless at a safe distance, or protection is provided for eyes and face | Store remote from water or moisture, oxidizing materials, chlorine, bromine, iodine, acids, and alkalies | Smother with an excess of dry graphite. Dry sand may be used on small fires. Not advisable to use sand around machinery. Do not use water, foam, carbon tetrachloride, or carbon dioxide | |
| Nitric acid | Carboys and glass bottles | May cause ignition when in contact with combustible materials; corrodes iron or steel; may cause explosion when in contact | Corrosive: causes severe burns by contact; deadly if inhaled | Safeguard against mechanical injury of containers; isolate from turpentine, combustible materials, carbides, metallic powders, ful- | | |

## Table of Common Hazardous Chemicals (Continued)

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| | | with hydrogen sulfide and certain other chemicals | | minates, picrates or chlorates | | |
| Phenol | | When heated yields flammable vapors. Flash point 172.4° F. | Poisonous | Soluble in water. Never store with or above foods products | | |
| Potassium permanganate | Tins | Oxidizing material. Explosive when treated with sulfuric acid, and in contact with alcohol, ether, flammable gases, and combustible materials | | Isolate from other chemicals, especially those noted under fire hazard | | |
| Potassium sulfide, also sodium sulfide | Iron drums, cans, glass bottles | Moderately flammable, yields flammable hydrogen sulfide on contact with mineral acids and sulfur dioxide when burning | Yields irritating and corrosive gases when burning | Safeguard against mechanical injury of containers | | |
| Potassium cyanide | Tightly closed glass, earthenware, or metal containers; wooden boxes with inside metal containers, or with hermatically sealed metal lining; metal barrels or drums | Cyanides not flammable but evolve hydrocyanic acid (see) on contact with acids or moisture | Highly poisonous when taken internally. Evolves hydrocyanic acid gas (poisonous) on contact with acids or moisture | Isolate. Safeguard containers against mechanical injury. | | |
| Potassium hydroxide | Wooden barrels, glass bottles | Generates heat on contact with water. | | Store in dry place; keep remote from water or moisture | | |
| Potassium nitrate | Bags, tins, and glass bottles | In contact with organic materials causes violent combustion on ignition. Classes with sodium nitrate | | Store in dry place, prevent contact with organic material | See sodium nitrate | See sodium nitrate |

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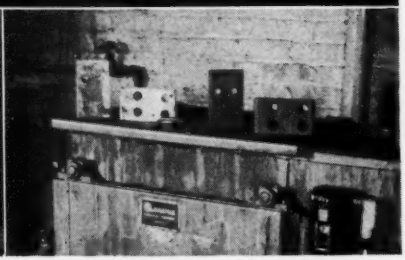
**BEFORE PLATING — For steel, Magnus 94XX. For brass, zinc, die cast and soft metals, the Magnus Electrex Cleaner suited to the metal and the dirt involved.**



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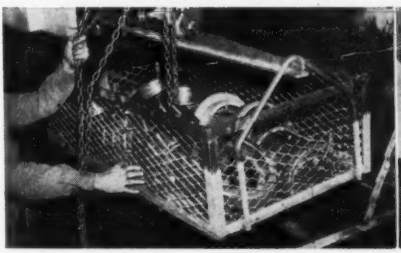
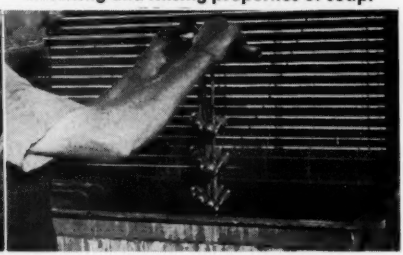


**AFTER STAMPING — For most lubricants on all metals but aluminum and zinc, Magnus 94XX. For the latter, Magnus 92S. For polished and machined aluminum, Magnus 91S.**



**AFTER BUFFING — For precleaning before electroplating and final cleaning where a physically clean surface is adequate, Magnusol in the Emulso-Dip or Emulso-Spray Process.**

With the right Magnus cleaner suited to the metal being cleaned, the nature and extent of dirt and the finishing operation involved, results can be still further improved by using the Magnus Cleaning Machine best adapted to your production set-up.

The Magnus Aja-Dip Cleaning Machine deserves investigation, because of its versatility and wide range of application, even where batch operations may not appear desirable at first thought, and its extra fast cleaning results.

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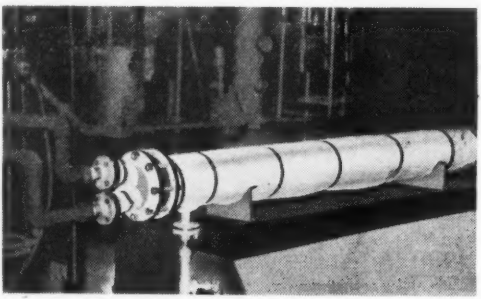

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*No Contamination*

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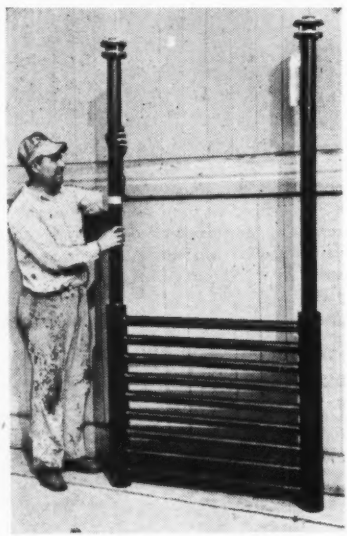

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| Usual Shipping | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|

**Table of Common Hazardous Chemicals (Continued)**

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| Silver nitrate | Amber or black glass bottles | Oxidizing material | Corrosive and poisonous | Store in dark place; keep cool and away from combustible material | | |
| Sodium chlorite ($NaClO_2$) | Wooden boxes with inside containers which must be glass or earthenware not over 2.25-lb. capacity, or metal not over 5-lb. capacity each | Strong oxidizing material. Decomposes with evolution of heat at about 175° C. (347° F.) Explosive in contact with combustible material. See potassium chlorate. In contact with strong acid liberates chlorine dioxide, an extra hazardous gas | Poisonous when taken internally. Dangerous under fire conditions | Isolate from combustible material, sulfur, and acids | Soluble in water. Water is best extinguishing agent | Used in bleaching textiles and paper |
| Sodium hydrosulfite | Wooden barrels, kegs, or boxes with inside glass bottles of capacity not exceeding 5 lb. each, or metal containers | Combustible. Heats spontaneously in contact with moisture and air, and may ignite nearby combustible material | | Store in dry place away from combustible materials | Smother with sand or foam | Bleaching agent for removing dyes |
| Sodium hydroxide | Iron drums | Classes with potassium hydroxide and calcium oxide | | Isolate from heat and water. See calcium oxide and potassium hydroxide | | |
| Sodium nitrate | Bags, tins, and glass bottles | Oxidizing material. Bags or barrels may become impregnated with nitrate, in which condition they are readily ignitable. In contact with organic or other readily oxidizable (combustible) substances it will cause violent combustion on ignition | | Store in dry place; prevent contact with organic or combustible material | Most fires involving sodium nitrate can safely be fought with water in early stages; at such times should be flooded with water. When large quantities, are involved in fire, sodium nitrate may fuse or melt, in which condition application of water may result in extensive scattering of molten mate- | Fire hazard less if removed from bags and stored in noncobustible bins |

## Table of Common Hazardous Chemicals (Continued)

| Name | Usual Shipping Container | Fire Hazard | Life Hazard | Storage | Fire-Fighting Phases | Remarks |
|---|---|---|---|---|---|---|
| | | | | | rial; therefore, care should be taken in applying water to material after fire has been burning for some time | |
| Sulfuric acid | Carboys, iron drums, glass bottles, and tank cars | May cause ignition by contact with combustible materials. Corrodes metal | Corrosive; dangerous fumes under fire conditions | Safeguard against mechanical injury, isolate from saltpeter, metallic powders, carbides, picrates, fulminates, chlorates, and combustible materials | Smother with sand, ashes, or rock dust, but avoid water | |
| Zinc powder or dust | Cartons, wooden barrels, or steel drums | Hydrogen evolved when commercial zinc is in contact with acids, sodium or potassium hydroxide, also by acid forming combinations containing zinc, such as zinc chloride and moisture. Dust may form form explosive mixtures with air. Zinc dust in bulk in damp state may heat and ignite spontaneously on exposure to air. | Zinc comparatively volatile at elevated temperatures. Under fire conditions precautions should be taken to avoid breathing fumes, which may cause metal fume fever. | Store in dry, ventilated place away from water or moisture | Smother with sand, ashes, or rock dust. Do not use water | |

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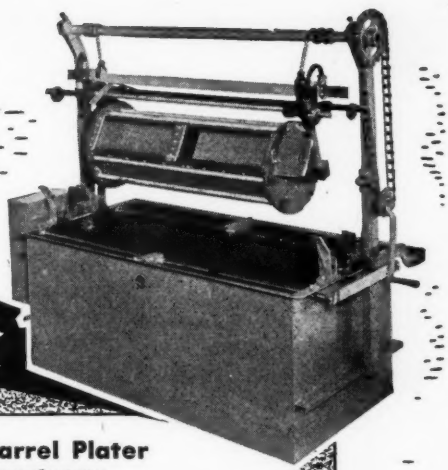
(6) International Critical Tables, New York, McGraw-Hill Book Co.

(11) Underwriters Laboratories, "Method for Classification of Hazards of Liquids."

(12) Underwriters Laboratories, "Report on Comparative Life, Fire and Explosion Hazards of Common Refrigerants".

(13) Underwriters Laboratories, *Report* MH 1676 (1927).

# SPEED PLATING BOOSTS PROFITS!



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# THE ADHESION OF ELECTRODEPOSITS

## III. CORRELATED ABSTRACT OF PUBLISHED METHODS FOR MEASURING THE DEGREE OF ADHESION

### A. E. S. Research Project No. 3

**Project Director: A. L. Ferguson**
**Associate: Elmer F. Stephan**

**Chemistry Department, University of Michigan**
**Ann Arbor, Michigan**

Outline of Paper

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Remarks by Blue, Braund and Sutton, Wood, Lewis, Mullin, Schaefer, Phillips
Suggested as quantitative test (Loose) ..... 1238
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*(Continued from November issue)*

### Heating Test

HEATING electrodeposits as a test for adhesion is one of the oldest methods used. It was first mentioned by C. F. Burgess[1]* in 1905. From that time until within the last few years, it is seldom mentioned, but recently it has received more attention. The comments of Dr. Burgess follow:

"An example of the failure of galvanized coatings is seen on galvanized pipes leading from heating furnaces. The alternate heating and cooling of these pipes frequently causes the zinc to become detached in large scales. To determine whether electrolytic zinc behaves in a similar manner, samples of various kinds of galvanizing were heated and cooled alternately and the effects thus produced observed."

M. W. Baldwin, in his article[6] of 1916 on plating aluminum, states:

"The metal can be heated to the melting point of aluminum without separation of the nickel."

R. D. Blue[46] (in discussion) remarks that after heating a certain electrodeposit on magnesium: "The absence of blisters proves the excellent adherence."

In the article[63] by B. K. Braund and H. Sutton on "Electrodeposition of Zinc and Cadmium on Aluminum and Aluminum Alloys", the statement is made:

"With the best samples, neither heating on a hot plate for 20 minutes at a temperature below the melting point of zinc, nor heating an edge with a blowpipe flame produced any blistering or detached the zinc deposit."

Donald Wood[90] mentions as one of several tests he used for adhesion of nickel on stainless steel "heating to 1300°F".

B. F. Lewis[103] states:

"The effect of anodic cleaning upon adhesion of the copper has been most apparent in the increased resistance to blister-

*Reference numbers refer to "BIBLIOGRAPHY" published in September issue.

ing at temperatures up to 350°F as well as at the normal temperatures."

In the discussion of an article[116] on the adhesion of thick silver plate on steel U. A. Mullin of the Wright Aeronautical Corporation states:

"To test for adherence we have a preliminary test which is a heat treatment at 950° to 1,000°F (510° to 540°C). If there are any areas of poor adherence not easily detected, for example, a small blister which does not have a pinhole exit, the heat treatment will increase the size of the blister so that you can see it."

In continuing the discussion of the same paper, R. A. Schaefer stated:

"We do obtain satisfactory adhesion as plated with a nickel strike without any heat treatment. We do, however, heat treat, as Mr. Mullin has already indicated, at 950° to 1,000°F to meet specifications A.M.S. 4815, but that is solely as an inspection tool, to cause those areas which have no bond or poor adhesion to blister."

Mr. W. M. Phillips, Head of Electrochemistry Dept., General Motors Research Laboratories Division, followed with the statement:

"Mr. Mullin suggested just about what we use. We anneal once or twice, and in some cases we anneal a second time to compensate for the cold working that we get in the machine, which puts a double task on the adherence."

He adds another interesting remark which is worth quoting here:

"We have tried some direct tensile tests but we quickly found that our bonds were stronger than the tensile strength of silver, that is, we could pull the silver apart before we could break the bond."

A slight attempt at making the heating test somewhat quantitative is indicated by W. S. Loose in an article[118] on nickel plating magnesium alloys. His statements follow:

"A third method that is much used on other metals such as zinc die castings consists of heating the plated metal in a furnace at 120° to 175°C to find the time required to blister the deposit. It is a question whether this is an adhesion test or a test to determine the amount of gas absorbed in the metal and pores. Nickel plated magnesium alloy die casting will withstand at least 72 hours at 175°C. When a die casting coated with a triple plate consisting of nickel-copper-nickel or nickel-cadmium-nickel is heated in this manner, not more than 1 to 2 hours' heating can be applied without blisters developing. In these triple plated samples the intermediate deposit was buffed to eliminate porosity. This difference may indicate that the absorbed gas escapes through the pores in the deposit in castings that have only the nickel deposit."

The simple heating test as used in the manner described by those mentioned above depends, for its effectiveness, largely upon gas contained in the base metal or at the interface which cannot escape but becomes less soluble or expands thus developing a pressure sufficient to push the deposited metal away from the base. It may result also from the vaporization of liquid or other volatile material entrapped somewhere.

A much more drastic test which not only includes the simple heating but adds another factor of considerable importance is used in many cases. This test involves heating the sample, then suddenly cooling it, or the reverse procedure. If there is an appreciable difference in the co-efficients of expansion between the base and the deposited metal a very strong force is developed tending to separate the two.

This type of test was used by F. M. Dorsey.[20] He states:

"Nickel deposited by the Madsenell process will adhere under bending stresses until the base metal cracks and can be heated to 1000°C and plunged into cold water without blistering or otherwise effecting the bond."

W. M. Scott in his article[17] on chromium plating states in this connection:

"An unburnt deposit on the same article can never be removed or scaled off. For example, a piece of steel, chromium plated, can be heated to cherry red, then immediately immersed in cold water without any effect upon the deposit."

R. Yates[98] applies this as a very severe test. He states:

"As an example of the excellent adhesion between aluminum and nickel that is established through the medium of the process described, it may be stated that aluminum permanent mold castings so treated have been heated to temperatures of some

800 degrees and plunged into a bucket of cold water without in the least disturbing the deposit of metal. This is one of the most brutal tests that could be made for any form of plating and offers testimony for the practical nature of the process. Sole plates of aluminum used on flat irons have been employed for months on end in commercial laundries without showing wear. The sponsors of the Travers Krome-Alume Process claim that repeated heating of nickel plated articles tends to increase rather than decrease the adhesion established. Continuous heating tends to alloy the nickel and the aluminum and rather than a form of abuse, it turns out to be an excellent method of furthering a still greater bond."

In another article[128] on the same subject he states:

"In the case of 2S and 3S metal adhesion reaches a point where it is practically impossible to remove the deposit except by rather violent chemical means. Such deposits may be heated in Bunsen flames, bent, ground, or flexed to the breaking point without risking the danger of lifting the plating. In every instant, heat increases the adhesion rather than decreases it. In one test aluminum sole plates for flat irons have been plated, heated to 700° and quenched in buckets of cold water without affecting the adhesion of the deposit."

### "Black Light" or "Fluorescent" Test

Another test of a distinctly different nature goes by several names, among them being "Black Light" and "Fluorescent". This test has received considerable attention during recent years, but the literature contains only very little information. It is well described and its value indicated in a part of the discussion[116] of the adhesion of silver plate on steel:

"Mullin, U. A.: If by chance you have an area of poor adhesion on the edge of a piece where the blister does not form because the pressure is released, the test for lack of adhesion in that location is the so-called black light test. This test consists of machining the part so that you have a clean interface between the silver and the iron. The part is heated in a paraffin base oil, allowed to cool with the oil on it, and then the surface oil is thoroughly removed. You can possibly use a quick solvent dip, but it is better to do it with clean rags so that the solvent will not remove any paraffin oil that might be in a crack or pinhole. After the surface oil has been completely removed, the piece is heated again, and if any paraffin oil has been absorbed in a crack or pinhole the heat will force it out. The area is now examined under ultraviolet light, causing the oil droplets to fluoresce.

"Incidentally, the black light test is used only after removing any excess amount of silver. For example, if you want to plate a band 2 inches (51 mm) wide, and have a good adherence for that entire 2 inch width, you will plate it possibly a sixteenth or an eighth of an inch wider on each side, and then remove that excess at the edges, because for some reason at the edges you will always get poor adhesion.

"Colin G. Fink: How would you remove the excess silver — mechanically?

"U. A. Mullin: Mechanically. To make a black light test effective, there must be a clean interface between the silver and the iron.

"I do not know that any of this is new, but I have come all the way from New Jersey for the express purpose of hearing the discussion on the adherence of silver.

"F. C. Mesle: With reference to the black light test, all it shows is either adherence or no adherence; there is no indication of the degree of adherence."

Earlier in this same discussion G. S. Krentel made the following highly intriguing statements:

"This question of the adhesion of silver deposits has passed the stage of testing by means of the hammer and chisel. I am sorry I am not permitted to say much on this point, but it is an accomplished fact that there are far superior ways to check and determine relative degrees of adhesion."

It turns out, however, that the test he was not free to expose was the same black light test described by U. A. Mullin and quoted above.

### The Erichsen Cup Test and Variants

A type of test which has been developed rather recently and is used by several companies especially for certain metal deposits, depends upon the deposit and base metal being deformed into a cup or flanged

depression by means of some sort of plunger. The size and shape of the depressing mechanism and the machine for operating it, also the depth of the depression, are all factors which vary with different operators. It is frequently referred to as the Erichsen Cup Test.

This was used by W. Blum[15] in testing the adhesion of nickel on iron and steel in 1925. In this connection he states:

"The adhesion of the nickel plating was measured by observing whether the nickel peeled, when the specimen was tested in an Erichsen penetrating machine, in which a plunger is forced against the sheet till rupture occurs. The test was not very conclusive, as all specimens stood it except those in which the preparatory cleaning was known to be defective or in which a large amount of iron was present in the bath and the deposit."

In a later revision[15] of the same article he made the same statement and added:

"When the initial adhesion was good, no failure was observed in this test, even when the plates were heated to nearly red heat (about 500°C or 932°F) and were then plunged into cold water and again tested. For purposes in which a very high degree of adhesion is required, it is probable that some more severe test must be developed than that here described."

In still another article[31] he makes some pertinent remarks on the whole subject of methods for measuring adhesion and especially on the Erichsen method. His statements follow:

"No exhaustive or very conclusive measurements have been published upon the adhesion of plated coatings. One reason for this dearth of literature is the difficulty of developing reliable quantitative tests for adhesion of thin layers. The only methods that are even promising are those which depend upon deformation of the base metal and observing the behavior of the coating. On sheet metal this deformation may be accomplished by a simple bending test, e.g., in a vise or over a mandrel of specified diameter.

"Another method is to apply the Erichsen extrusion test to the coated sheet and to observe whether the coating has flaked or peeled when the base has failed. A modification of this method has been applied to chromium-plated cast-aluminum alloys in a few unpublished tests made at this Bureau. In these tests indentations were made by the ball of a Brinell testing machine with increasing leads, until it was evident that the chromium coating had detached. The results were roughly reproducible and appeared to have some significance. At best, however, such tests usually show that under given conditions the coating does or does not adhere and yield little or no information regarding the relative adherence."

S. Wernick[26] used a cupping method to test the adhesion of cadmium but makes no comments.

R. B. Mears[45] of the Aluminum Company's research laboratories made some interesting comments on the Erichsen method:

"For plated sheet metal the Erichsen type of test can be used with considerable success, especially for deposits of the harder metals, such as nickel or chromium. Coatings of soft metals, such as lead and zinc, deform so easily that their adherence is very poor indeed if peeling or flaking occur upon exposure to this type of test. In this test, a ball-shaped mandril is pushed into the specimen a measured distance. Poorly adherent deposits peel or flake from the base metal after a few millimeters distortion while adherent deposits exhibit no peeling, even when the base metal has been cracked by the penetrating mandril."

W. R. Meyer[111] in discussing the Erichsen test gives photographs which well illustrate the difference in results obtained depending on whether the deposit is ductile or brittle:

"In detecting brittleness in plated coatings, a cup test, such as the Erichsen cup test, in which a steel ball is pressed into firmly held sheet to produce a cup of any desired depth, is valuable. Fig. 1 (*our Figs. 24* and *25*) shows tests on ductile and brittle nickel deposits."

Recent publications show that others have used and made comments on the Erichsen method or variants. M. H. Corbin[76] uses the method to test the adhesion and flexibility of paints. S. G. Clarke[64] used another variant to test black lead peroxide coatings. In a series of articles B. Egeberg and N. E. Promisel[77,78] make these interesting observations:

"Erichsen deep drawing tests may be

used, but are applicable only to flat articles or flat sections of articles of correct gauge for the machine. The results must be cautiously interpreted, however, since the ductilities of both the deposit and basis metal are involved.

"A modification consists in indenting the surface with the ball of a Brinell machine under increasing loads and observing the stage, if any, at which the coating becomes detached.

"Reports indicate very satisfactory results

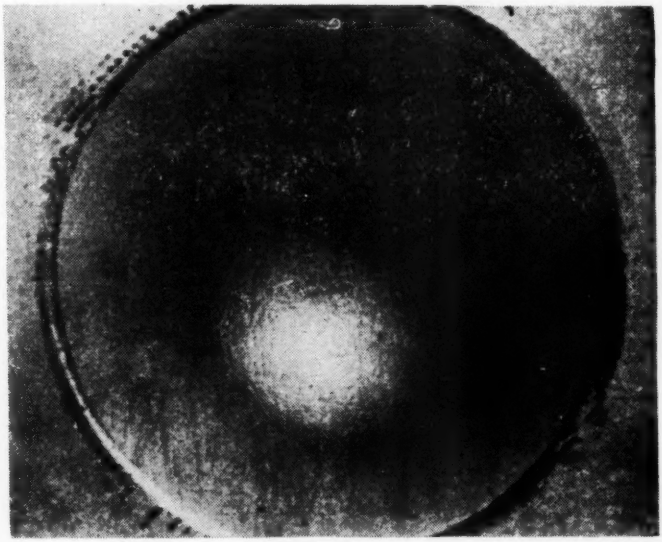

Fig. 24. Olsen draw cup of ductile nickel deposit. Note absence of cracking.

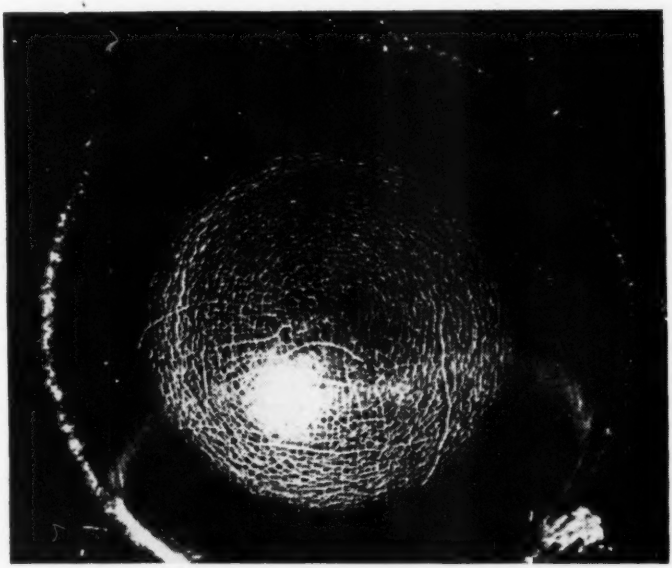

Fig. 25. Olsen draw cup of brittle nickel deposit from solution containing extract from unwashed filter bags.

with this type of test on chrome."

In an extensive study of ductility and adhesion of nickel deposits, F. P. Romanoff[55] used the Erichsen extruded cup test in which a one-inch steel ball was impressed to a depth of 0.225 in. This was standard in all cases except where extrusion to fracture was employed. The condition of the deposit on the dome was used as indication of ductility and adhesion. Our Fig. 26 is a reproduction of his Fig. 3,

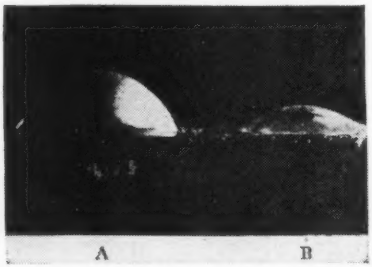


**Fig. 26. Erichsen cup test specimens. A shows depth of extrusion, 0.340 in. (8.64 mm.), at fracture of ductile nickel which is same depth as for unplated copper base. B shows depth of extrusion, 0.140 in. (3.56 mm.), at fracture of hard fibrous nickel over copper base.**

which illustrates the domes and their use in testing ductility and adhesion. After much work had been done he concluded that this is not a reliable test for adhesion. He then developed a modification which he calls the "flanged cap adhesion test", which he states will always detect poor adhesion. His remarks on these are highly significant:

"We found that whenever poor adhesion was encountered, hard columnar nickel deposits of approximately 0.0003 in. (0.0076 mm) thickness, almost always became detached from the dome during the extrusion test. Heavier deposits of about 0.001 in. (0.025 mm) usually appeared intact. However, separation was more or less easily accomplished if the specimens were sheared and a knife or other implement inserted between the nickel and the base. Notch propagation from the fractured nickel to the copper base was not as severe as in the case of good adhesion.

"When ductile nickel of 0.0003 in. (0.0076 mm) had imperfect adhesion to the base, the appearance of the dome of the extruded cup varied from its normal appearance to that of a decided cracked surface. The large fracture noticed in Fig. 16, with its lesser branches, appears more severe than in the hard nickel dome of Fig. 4. This effect, however, does not always appear when ductile nickel is extruded. Apparently perfect domes may occur in spite of poor adhesion. The surface appearance is probably a function of the degree of adhesion of the nickel to the base.

"Flexing of the unstressed part of the specimens by bending it caused the nickel to part from the base, close to, but not over the extruded area. This is a rather odd condition which often arises when the poorly adhering ductile nickel will peel at points all over the specimen save on the extruded dome. (*See our Figure 27*).

**Fig. 27. Flexing of unstressed part of Erichsen cup with poorly adherent ductile nickel produced peeling except on cap of dome.**

"The extruded cup test is considered entirely unreliable for determining the degree of adhesion of deposits. The flexure test was more indicative than the extrusion test, but this was also unsatisfactory, because heavy deposits of ductile nickel, about 0.001 in. (0.025 mm), gave no indication of poor adhesion when subjected to either type of these tests."

After Romanoff became convinced that the Erichsen test he had used gave no indication of poor adhesion, he searched the literature for something better, but not finding a test that would answer his purpose, he devised a new adhesion test that also indicated the degree of ductility. It is simply another modification of the Erichsen test.

"As all of the material processed in regular production was to be subsequently fabricated into articles as illustrated in Fig. 18, a new adhesion test was developed, which test also indicated the degree of ductility of the deposit. The test furthermore

helped to estimate the maximum deformation permissable before the polished deposit would lose its lustre.

"The apparatus consisted of an ordinary punch press with a set of adjustable dies for drawing a flanged cap. The flange is 2.5 in. (63.5 mm) in diameter and the cap 1.5 in. (38 mm) in diameter. The depth of the cap is adjustable from zero to 0.5 in. (12.7 mm). Fig. 19 (*our Fig. 28*) shows a full view of a test specimen.

**Fig. 28. Flanged cap test specimen stamped from strips cut from regular production sheets.**

"Our specimens are usually tested to a point which will fracture the cap. This provides information as to the ductility of the base and adhesion of the electrolytic deposit. The intact part of the draw shows how drawing affects the structure of the deposit. Deposits of nickel over 0.002 in. (0.05 mm) thick will not evidence poor adhesion as readily as do thin deposits and, unless the cap is fractured, may not be detected. Fracturing of the cap will disclose poorly adherent deposits of nickel of almost any thickness.

"The press runs at a speed of 100 stampings per minute. This test has proven entirely satisfactory for testing adhesion and ductility of metallic or non-metallic coatings on base metals of sheet steel, tinplate, zinc, copper, brass and monel.

"*Conclusion:* A test for adhesion and ductility of electrolytic nickel and other coatings on sheet metal by stamping out a flanged cup is more reliable for determining adhesion than any other test used for this purpose."

From the information recorded in the literature one might draw the following conclusions:

1. Some form of extrusion test is likely to give valuable information about the ductility of electrodeposits provided the ductility of the base metal is sufficiently high.

2. The test as usually carried out is not a satisfactory test for adhesion if the deposit has high ductility.

3. As a test for adhesion of more brittle deposits such as chromium and hard nickel it is fairly satisfactory.

4. The method is applicable only to relatively thin deposits.

5. The particular variant of the Erichsen test devised by Romanoff known as the "Flanged Cap" test may prove satisfactory for testing adhesion even for ductile coatings.

6. It is a very rapid test for situations where it gives satisfactory results.

### Miscellaneous Tests

Several tests are mentioned in the literature which, while excellent for certain types of deposits, have limited application. These have all been grouped under the heading miscellaneous, but will be considered individually.

#### *Scratch Tests*

Ap Roberts used a scratch test in an article[124] on plating on magnesium. His method:

" . . . consisted of making two scratches through the deposit at approximately a 30° angle to one another and determining the difficulty of lifting the plate with a pointed tool. The results showed that a good deposit would break off, not independently, but with a portion of the base metal adhering."

Several others have used this method as described or with slight variations. One common type of variant is described by C. F. J. Francis-Carter:[58]

"Make a deep scratch in one direction in the deposit, and then four or five others across it at right angles. Peeling at the points of intersection would indicate poor adhesion, although absence of peeling would not necessarily denote perfectly adherent deposits."

These scratch tests are applicable only to thin deposits. In a private conversation a representative of one of the large bearing manufacturers described a somewhat similar test which he uses to test the adhesion of very thick deposits. Parallel cuts are machined about ¼ inch apart, then another set at right angles. This leaves a set of rectangular projections. A blunt chisel is then placed against the projections and

hit by a hammer. This is a very severe test for a deposit which is hard. Another even more severe test is to break the base metal along one of these cuts and attempt to remove the projection of plated metal by means of a sharp chisel. A deposit that stands these tests is considered perfect.

### *Chisel Test*

Another type of chisel test used by Hothersall[37] has already been briefly described and illustrated [MONTHLY REVIEW, **32**, 1130 (1945)]. It is sometimes combined with what is called the "saw test" or "hinge test". The test is made by saving practically through the base metal then bending the uncut deposit back on itself. If the adhesion is not very good, the deposit will pull away more or less from the base metal as illustrated in Fig. 9, page 1135. In case there appears to be no separation at the fracture by the unaided eye it is examined by some under a microscope. If this reveals nothing, then a very thin sharp chisel is used in an attempt to separate the deposit while the sample is held in a vise. This is an extremely severe test and indicates weakness when the previous tests fail. It is satisfactory only for deposits thicker than 0.01".

F. C. Mesle made an interesting comment on the chisel test in a discussion of a paper[116] on the adherence of thick silver plate on steel. His statements follow:

"I am interested in this question of adherence. Only yesterday at Rock Island we were discussing this question with engineers who were rather critical of the ability to plate silver on steel and, of course, methods of testing were under consideration. Testing methods are changing. We are now asked to plate a thickness of 0.04 in. to 0.06 in. (1.0 to 1.5 mm) of silver and for this thickness the hammer and chisel adherence test is in general use."

This chisel test is mentioned by several in the literature and by even more in private communications. It is applied in various ways and is rather generally considered the most severe that can be made.

### *Sawing Test*

Simply sawing the strip having an electrodeposit is used by many as a good test for adhesion. A hard or brittle deposit will flake off and even a soft deposit may pull away more or less. The microscope is often used to permit close observation.

### *Grinding Wheel Test*

A test somewhat similar to the sawing test, but much more severe, was extensively used by the late E. M. Baker. He describes it briefly in a discussion of an article by C. J. Brockman and J. H. Mote[79]:

"A crude but effective method of testing the adherence of electrodeposits is to hold the plated article against a rough emery wheel so that the wheel cuts from the base metal to the deposit in a jerky or bumpy fashion in contradistinction to the way in which one would ordinarily grind a piece of metal with a wheel. This is particularly effective on very hard electrodeposits, as apparently this procedure produces a high local stress between the plate and base metal."

Some specify the wheel should be dry and also give the dimension and speed of rotation. This method is at present considered by some of the best platers in the country as a very satisfactory, quick and effective shop method especially for deposits not too thick. It is not considered a good test for deposits of ductile metals.

Another type of grinding test is used by some. It consists in grinding through the deposit with a dry emery wheel. A test much like this is automatically involved in certain types of electroforming in which worn parts are built up to oversize, then ground to correct dimensions. If the deposit adheres at the interface between the original metal and the deposit during the grinding operation, the bond is considered satisfactory.

### *Cathodic Treatment*

Several have mentioned the use of what might be called a cathodic treatment test. The plated object is made cathode in a solution from which only hydrogen is evolved. Usually a high current density is used for a rather long time. It is reported that for certain types of deposit and for some base metals, the deposit, after standing for some time, is lifted, usually as blisters. This blistering is hastened by heating. In special cases where adhesion is poor, the deposit is lifted during the elec-

trolysis. The principal argument used in support of this test is that it is non-destructive.

### *The Mesle "Can Opener" Test*

An ingenious test developed by F. C. Mesle in a very extensive research is described by him in an article[96] entitled "The Adhesion of Electrodeposits". The following is a description of this test and the manner in which he used it in his own words.

"The test panels were processed so that the deposit could be peeled from the top of the panel, thus giving opportunity to take hold of the deposit and pull. The pounds pull required either to peel or break the plate will indicate the degree of adhesion to the base metal plated. I made a tool that I think has some merit, and that indicates the comparative degree of adhesion, even if it is difficult to to express the adhesion in exact pounds per square inch. The tool is a slotted ¼" drill rod connected to a steel wire coil spring. The plate is peeled (if it can be peeled) after the manner of opening a sardine can. The tension put on the spring is the measure of the load required to peel or break the deposit. Each fraction of a turn is given a number that indicates the load required much the same as the load required to pull the needle from the magnetic surface in testing the thickness of plated coatings. Pull No. 1-2 means that between one and two pounds pressure is applied to ½" of plated metal that is being pulled from the base. Pull No. 10 means that more than 10 pounds pull was used. If this load did not peel or break the deposit, the adhesion rating given is 100%. I would estimate that this rating gives at least 2 tons per square inch. I realize there are too many factors that can change that make it difficult to be sure that the pounds pull is that which the test indicates. If the pull is not applied evenly the plate may tear rather than break. The same is true if the adhesion is uneven where the pull is exerted; the plate will tear rather than break. These factors would indicate less than the real adhesion. I think a fair comparison can be made of the degree of adhesion between various samples tested.

"If the plate peels at less than pull No. 1, it is rated as very poor or 5%. 1-2 poor, or 15%; 2-3 fair or 25%; 3-4 good, or 35%; 4-5 at 45%; 5-6 very good or 55%; 6-7 at 65%; 7-8 excellent or 75%; 9-10 at 95%; and 10 perfect or 100%. To apply the maximum load of No. 10 pull, the deposit should be at least .005" thick; because it was convenient I built this thickness with silver; high speed copper, could no doubt be used. Bright nickel, too, is brittle, and it will break rather than bend around the ¼" drill rod.

"A deposit rated as fair or better could be considered as satisfactory for general purpose plating, but it is suggested that plating methods that produce perfect adhesion should be the goal of everyone going to do quality plating. The nearer we approach this goal, the lower the percentage of failures due to poor adhesion."

In the hands of a single person this method is capable of giving relative semi-quantitative results. Another person using the same method would probably not obtain the same values. By more intensive study and careful designing and by the introduction of a method for measuring the actual force in pounds, still more quantitative results might be obtained. Serious difficulties would arise, however, if one were to attempt to interpret such data in terms of pounds per square inch, or even in terms of pounds per inch.

### *The Jacquet Test*

A method somewhat similar to this but possibly more elegant was developed by Pierre A. Jacquet.[62]

"A clear understanding of the principles of adhesion of an electrodeposit to the basis metal is important from both a purely scientific as well as a commercial point of view. At present the adhesion is estimated merely qualitatively. Thus, coatings on metal sheets are tested either by repeated bending or by cupping. Quantitative measurements are possible by Ollard's method, but his method is adaptable only to very thick deposits, (minimum 2.5 mm or 0.1 in.), which greatly reduces the usefulness of the method, since the usual deposits are at most a few tenths of a mm thick. Moreover, Ollard's method requires special test specimens, very carefully prepared.

"We have endeavoured to adapt our method (Fig. 2) (*our Fig. 29*) to determin-

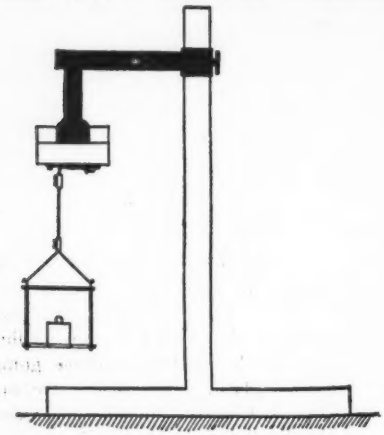

Fig. 29. Schematic view of Jacquet's adhesion tester.

ations of the adhesion of any electrodeposit on any basis metal. For example, take a steel basis plate with an electrolytic nickel deposit. The adhesion of the nickel deposit has to be tested. The area ABCDIJ (Fig. 1) (*our Fig. 30*) is marked on the

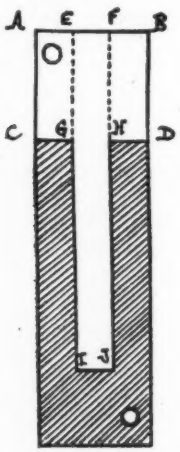


Fig. 30. Jacquet's cathode plate for measuring shearing stress and adhesion.

nickel plate with a suitable engraver's tool. The rest (shaded area) of the plate is varnished. The area ABCD is dipped into a protein solution and then rinsed. The plate is then completely immersed as cathode into a copper bath and copper is deposited on top of the nickel to a thickness of about 0.30 mm (12 mil). The copper deposit does not adhere to the part ABCD on account of the protein film, and is easily lifted, but the copper strip GHIJ shows normal adhesion. If this adhesion is stronger than the adhesion of the primary nickel coat to the steel base, this nickel strip will be detached by the method shown in Fig. 2 (*our Fig. 29*). Before applying the test, it is necessary to groove or scratch the nickel coating along GH underneath the copper deposit.

"Our experiments have shown that this adhesion test is applicable to poorly adherent nickel deposits only, e.g., for those on steel, which had been pickled in a cold 50 per cent hydrochloric acid solution. When nickel adheres well, it is impossible to detach it, the adhesion of copper to the nickel or the tensile strength of copper itself not being strong enough. By our test, the copper will separate from the nickel. Accordingly, we set out to find a more adherent copper deposit.

"In carrying out the adhesion tests, whenever the necessary weight exceeded 2 kg., a lever device was made use of, as shown in Fig. 3 (*our Fig. 31*). There is,

Fig. 31. Jacquet's improved adhesion tester.

of course, an upper limit in weight which corresponds to the tensile strength of the copper strip; too thin a strip will pull apart before the nickel deposit is separated from the steel."

This has since been referred to by others as Jacquet's method.

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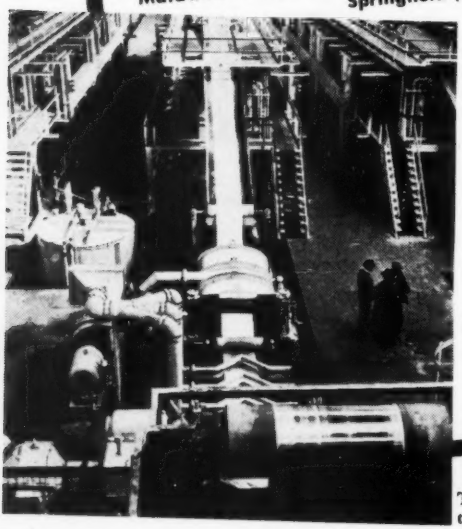

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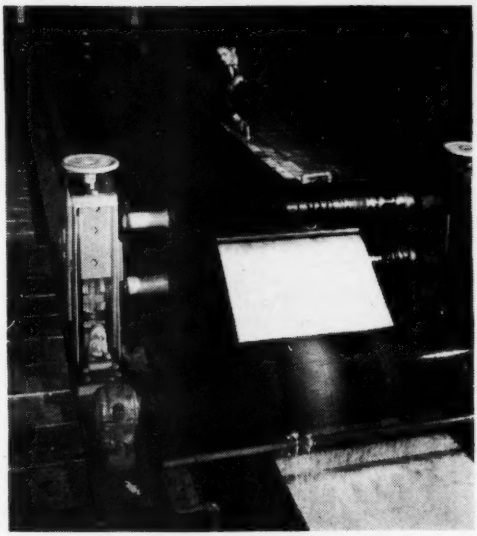

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Total its outstanding advantages. Consider what they can mean to you as an electrotyper, gravure printer, producer of composite copper-nickel coatings, or manufacturer of other copper-clad products that must be plated at fastest rate consistent with quality work. Then—try General's Copper Fluoborate for your plating!

For technical data . . . trial samples . . . or other helpful information on this product, contact General Chemical Company Fluorine Division, 40 Rector Street, New York 6, N. Y. or the nearest General Chemical Sales and Technical Service Office.

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## Having trouble getting cotton buffs and polishing wheels? Try FELT

Felt wheels or buffs, properly selected as to hardness, can perform many operations as well as, if not better than Cotton or other Polishing Wheels. They hold the abrasive and their shape better. They produce a higher finish and expedite subsequent buffing. And they have exceptionally long life.

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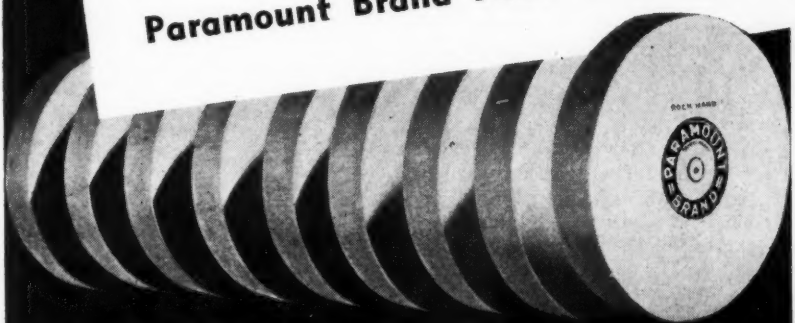


# BACON FELT COMPANY

*"America's Oldest Felt Manufacturers"*

Winchester, Mass. Established 1824

By DR. HAROLD J. READ

**ELECTROPLATING — *A Survey of Modern Practice*** by Samuel Field and A. Dudley Weill. 5th edition. viii+483 pages. Pitman Publishing Corp., 2 West 45th St., New York, and 205 West Monroe St., Chicago, Ill. (Printed in Great Britain), 1945. Price $5.00.

The popularity of this English text may be judged from the fact that five editions have appeared over a span of but 15 years —a rather unusual record for a monograph on a specialized process.

Of the twenty-four chapters, the first ten, comprising 186 pages, are devoted to fundamental principles, general topics of electrochemistry and cleaning. The following eleven chapters, 216 pages, treat in detail the deposition of various metals and alloys, while the final three chapters, 81 pages, cover a variety of subjects including the testing of deposits and metal coloring.

The introductory chapters, particularly those dealing with electrochemistry and the principles of electroplating, have been written for the reader who does not have an extensive background of technical academic training. The subjects discussed are illustrated with drawing and analogies, and typical examples are worked out wherever calculations are involved as part of the subject matter. The approach is that of the older "classical" chemistry, but it serves the purpose very well in this instance. The discussions of the materials used in electroplating and throwing power are unusually complete. It is to be regretted, however, that the section on pH and its determination neglects completely all of the electrometric methods of determining this important property of plating solutions.

The information on plant lay-out for plating and cleaning is, of course, based on British practice and equipment. It provides an interesting opportunity for the reader to compare the mechanical contrivances which are available in this country with those used in England. It is somewhat surprising that while vapor phase degreasing is discussed rather thoroughly, little or nothing is said on the modern developments involving the use of the various silicates in chemical or electrolytic cleaning baths.

In the long section devoted to details of the methods used in depositing specific metals, the reader will find rather marked differences in many instances between the recommended plating solutions and conditions and those which represent American practice. A few examples will illustrate this point. For acid copper plating the authors recommend an acid concentration which is only a little more than half of that commonly used in this country. For work with nickel the emphasis is on cold baths containing a relatively low proportion of chloride and boric acid, and operated at very high pH values. The concentration of free cyanide given for silver plating solutions is much lower than that used in America. These differences and others of the same sort are probably attributable to the fact that colder solutions and lower current densities are used in English plant operations.

Although the present edition is dated 1945, there are very few references of later date than 1942. This is reflected in the inadequate section on tin plating where the tinning of steel strip is dismissed with a brief paragraph. The few paragraphs devoted to lead plating are also

out-dated. The chapter on alloy deposition deals mainly with the plating of brass, and very little reference is made to the fairly extensive publications of the past few years on the electrodeposition of bearing and other alloys. The nine pages on metal coloring describe a few of the more classical methods, but obviously not in any detail.

On the whole, the book is valuable in that it represents something other than the American viewpoint on practical electroplating. It should be in the library of those electroplaters who are interested in having available a complete background of literature.

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**(1) Electroplating—S. Field and A. D. Weill, Fifth Edition, 483 pages, $5.00.**

**(2) The Fundamentals of Electrochemistry and Electrodeposition, by Samuel Glasstone, 90 pages, $2.00.**

**(3) Principles and Applications of Electrochemistry, Volume I Principles. H. Jerman Creighton, Fourth edition, 477 pages, $5.00.**

**(4) An Introduction to Electrochemistry, by Samuel Glasstone, 553 pages, $5.00.**

**(5) Modern Metallurgy for Engineers, by Frank T. Sisco, 432 pages, $4.50.**

**(6) Standard Handbook for Electrical Engineers, Edited by A. E. Knowlton and R. M. Shook. 2303 pages, $8.00.**

**(7) Hardness and Hardness Measurements, by Samuel R. Williams, 558 pages, $7.50.**

**(8) 32nd A.E.S. PROCEEDINGS, 6½ x 9¼ cloth, 279 pages, $5.00. Contains all technical papers and discussion presented at 32nd Annual Convention.**

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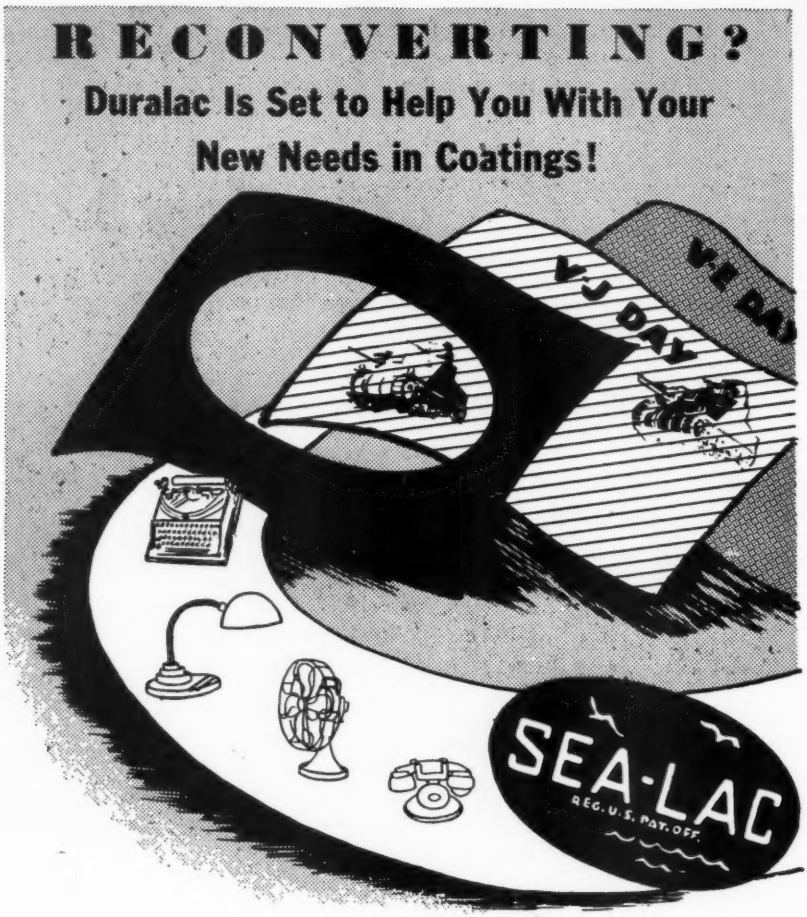


AT a moment's notice, we can step in and aid you in working out the specific finish you require. That's because we are a flexible organization, offering a tailor-made service. We proved our versatility to the complete satisfaction of many harrassed manufacturers throughout the tough war years. Today, with the release of long-absent materials, we're geared to do an even better job of trouble-shooting. . . Let us know what your reconversion program calls for in finishes. We'll give you the benefit of our specialized skills and knowledge.

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# INDUSTRY NEWS

## Wanted
## Foreman Electro Galvanizing Department

Must have some practical experience. Also some background of chemistry to take charge of plating department closed during war. Supervision of 6 to 10 men. State age, school background, practical experience and salary expected. Farm equipment manufacturer. Town of 10,000, Iowa. MR 12-2, MONTHLY REVIEW, P.O. Box 168, Jenkintown, Pa.


**Production Engineer**

**Plating and Polishing**

Familiar with Automatic polishing and buffing of steel and die casts parts similar in size to automobile bumpers and radiator grilles. Definite past experience in various phases of copper, nickel, and chrome polishing and buffing is essential. Position is with automotive company in Michigan having large installation of automatic plating and polishing equipment. Write MR 12-1, *Monthly Review*, P. O. Box 168, Jenkintown, Pa.


## Silver Plater Wanted

For repair work, hollow-ware, etc. to head up department. Permanent, satisfactory arrangements for right man. Agreeable working conditions. Location New York State. Address MR 12-3, MONTHLY REVIEW, P.O. Box 168, Jenkintown, Pa.

## Rate of Plating Operations in New York

The October "Monthly Bulletin" of the Masters' Electroplating Association, New York City reports: "The rate of operations among the members of the Association for October was 67½% compared with 64% in September and 72½% for October, 1944, based on our present method of calculation.

The industry is still suffering from lack of polishers. Business would rise to a much higher level if the necessary skilled help were available.

Dull finishes for industrial purposes, rust prevention, etc., have dropped to a very low ebb. Almost all of the customer demands are for bright polished surfaces. In this department, platers are swamped with orders, booked for months ahead.

The Association placed a number of advertisements in out of town newspapers for polishers, in the hope of bringing in some men from plants where lay-offs had been heavy, to remedy our existing shortage. There were very few responses to our ads and they were from men inexperiencd in job shop work."

## Narcus Forms New Company

Mr. Harold Narcus, formerly connected with the Industrial Chromium Corporation

and Plating Processes Corporation of Holyoke, Mass. announces the formation of a company, Electrochemical Industries, to be located in Worcester, Mass. This company will specialize in the plating on plastics and other non-conductors and will offer consulting service to both the plastics and plating industries.

Mr. Narcus is widely known in the plastics and plating fields having written numerous technical articles on these subjects and addressed several branches of the American Electroplaters' Society. The plating on plastics was the subject of a paper presented by him at the 1944 Annual Convention of the A.E.S. in Cleveland. A technical paper on the metallization of plastics was given by him at the Fall Symposium on "Before and After Plating" before the Electrochemical Society in New York City.

## Plastics Exhibit Slated for January

Plans have been completed for the first postwar Plastics Show with the announcement of the S.P.E. Plastics Exhibit to be held in Detroit's Convention Hall from Monday, January 7 through January 11, 1946. This Plastics Exhibit will be largest ever held in America, according to Fred Conley, Publicity Committee Chairman of the Exhibit. "The floor plans show a greater area of exhibit space than ever before allocated to this type of industrial show" he said. "For the first time ever," Mr. Conley continued, "The S.P.E. Plastics Exhibit as it will be known in industry, will be a forthright effort on the part of exhibitors to sell their products."

The Society of Plastics Engineers Annual Meeting will also be held in conjunction with the Plastics Exhibit in the East Wing of the Horace H. Rackham Educational Memorial, 100 Farnsworth Avenue on January 7, 8, and 9 and will include daily technical sessions sponsored by the Professional Activity Groups of the Society. Other associations and industry groups will also meet in Detroit during the week of this event. A feature of the three-day technical program planned by the Society of Plastics Engineers will be a series of educational courses consisting of lectures for both morning and afternoon sessions. Subjects of these courses are: Materials, Molding Technique, Product Design, Symposium on Laminates, Tool Design, Coatings, Consumers' Specifications and other subjects. The regular technical sessions will present the papers which will be listed by title and author in a bulletin to be distributed to S.P.E. members and to anyone interested who will request them.

## Parker-Wolverine and Udylite Merger Progressing

A proposed merger of the Parker-Wolverine Company with The Udylite Corporation, both of Detroit, was agreed upon by directors of both corporations and will be submitted at meetings of shareholders of both companies on February 20, 1946, according to an announcement, November 15, by L. K. Lindahl, president of The Udylite Corporation.

The Udylite Corporation, producers of all types of metal finishing equipment and supplies, operates three Detroit plants. Parker-Wolverine produces finished fabricated parts and renders metal finishing service from five Detroit plants. "Integration of these operations will mean better service to industry," stated Mr. Lindahl.

The proposed merger provides for issuance of 2½ shares of Udylite stock for each of the 135,931 shares of outstanding Parker-Wolverine stock.

Charles H. Awkerman, chairman of the board, L. K. Lindahl, president, Clyde H. Reeme, vice president and treasurer and Horace S. Maynard, secretary, along with Willard M. Cornelius and Luis E. Eckelmann are the directors of The Udylite Corporation. They will continue as officers and directors of the continuing corporation.

## Material Handling Society Formed

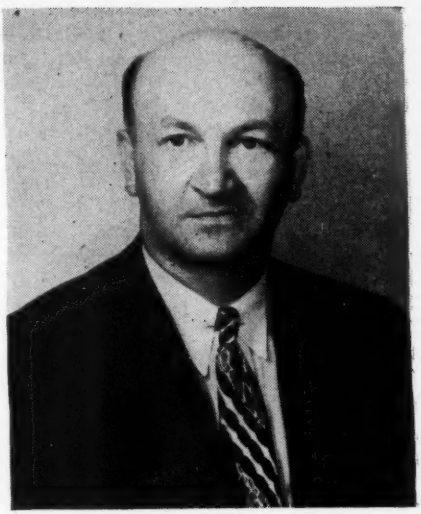
During October material handling experts in the Pittsburgh area joined together and formed the "Material Handling Society". Membersip in the Society is open to anyone interested in material handling problems. Recommendations of the Constitution Committee, adopted recently provide for dues of $5.00 per year for members with sustaining memberships available for cor-

porations and individuals who wish to contribute to the support of the movement. T. O. English of the Aluminum Company of America is the Temporary Chairman, and Richard Rimbach, 1117 Wolfendale St., Pittsburgh 12, Pa., is Temporary Secretary. Several meetings have already been held with the next scheduled December 17th at which time the Program Committee expects to have another interesting and informative program.

## United Chromium Announces Promotions

To coordinate their expanded sales activities, United Chromium announces a reorganization of Eastern Sales territories and the appointment as District Managers of three men who, through technical training as well as first-hand acquaintance with the every day problems of platers, are well equipped to serve the industry.

Henry Mahlstedt has been named Sales Manager for the Eastern Division, supervising all activities east of Buffalo, with headquarters in the company's New York Offices. He is a graduate Chemical Engineer and before joining United Chromium in 1928, was Chief Chemist for New York Steam Corp., and Multiple Storage Batter Corp. Mr. Mahlstedt's broad knowledge of the installation and operation of metal finishing processes has won him wide respect among Eastern manufacturers and job platers.



Meyer Shacat is now managing the New England district, making his headquarters at the Waterbury office and plant. A graduate of M.I.T. in Chemical Engineering, "Mike" spent a number of years in research and development work with American Bosch Magneto Corp., and Gould Storage Battery Co., joining the United Chromium organization in 1929 as sales and service engineer.

E. N. Riotte has been named District Manager to supervise activities in New York, New Jersey and Pennsylvania.

"Gene," who will make his headquarters in the New York office, is a graduate of Yale University and has been active in sales and service engineering work with United Chromium since 1934.

## Prize Contest Announced

A contest for the design of the "Gas Range of Tomorrow" involving 16 cash awards totaling $18,000 will be conducted by the American Stone Company, S. E. Little, Vice-President, has announced.

The Contest is open to all residents of the U. S. except employees (and their families) of American Stone Co. and its subsidiaries, its advertising agencies, *The Architectural Forum*, or employees of other range manufacturers.

All rules and details of the contest which opens in November and closes March 1, 1946 are covered in a free booklet obtained by writing to George Nelson, A.I.A., c/o *The Architectural Forum*, Dept. P-3, Empire State Bldg., 350 Fifth Ave., New York 1, N. Y., mentioning Magic Chef design contest.

## C. H. Sample Becomes Chief Engineer for Rheem Research

Clarence H. Sample, formerly a member of the Technical staff of the Bell Telephone Laboratories, has joined Rheem Research Products, Incorporated, Baltimore, as Chief Engineer.

In this capacity, Mr. Sample's chief task will be to coordinate technical matters among the Research Laboratory, Pilot Plant, field tests, and commercial applications for the Company's product, Iridite. He will also work closely with the Sales and Marketing Departments in the role of an advisor on technical problems.

Mr. Sample is widely known in the field of metal finishing, having been directly responsible for corrosion research and the development of protective coatings at the Bell Laboratories since 1930.

A prominent member of the American Society for Testing Materials, Mr. Sample is Secretary of Committee B-8 on Electrodeposited Metallic Coatings, Vice Chairman of Committee B-3 on Non-Ferrous Metals, and holds memberships on Committees A-10 on Iron-Chromium and Related Alloys, and B-7 on Light Metals and Alloys, Cast and Wrought. Mr. Sample's other technical and professional activities include memberships in the American Association for the Advancement of Science, American Chemical Society, American Electrochemical Society, and the American Society for Metals.

## New Large Plating Plant for Chicago

Dover Industries, Inc. announces the start of operations at its plant located at 2929 N. Campbell Ave., Chicago 18, Ill. This is a new enterprise which was organized to do manufacturing and jobbing of metal articles requiring plated finishes. The company's executives have each had from ten to twenty years of experience in the metal finishing industry. L. D. Jensen, formerly Vice-President of Chromium Corp. of America, is President; O. A. Wettlaufer and E. L. Berkenkotter, formerly Sales Manager and Plant Superintendent, respectively, of Chromium Corp. of America, are Vice-Presidents; and K. W. Schwartz, formerly Vice-President of United Chromium, Inc., is Treasurer.

An industrial site with 45,000 square feet of available space has been acquired. Modern and complete facilities have been installed for hard chromium plating and heavy nickel plating on equipment weighing up to 5 tons and 22 feet in length.

In addition, equipment is available for cadmium, zinc, tin, lead, silver, copper, nickel and chromium plating to exact specifications. The company will also do Alumilite finishing and Vapor Blasting.

## Pellington Appointed Sales Manager for Puritan

The Puritan Mfg. Co., Waterbury, Conn., manufacturers of the well-known Presaponified Wonderbar Buffing Composition, announces the appointment of Mr. Russell H. Pellington as manager of sales. Mr. Pellington, since 1924 has been selling and servicing polishing and buffing compositions in the New England States. He is a member of the Hartford Branch of the American Electroplaters' Society.

## Du-Lite Chemical Appoints Verner to Research Fellowship on Metal Finishing

Containing its research program in metal finishing at Syracuse University, the Du-Lite Chemical Corporation of Middletown, Conn. has awarded a fellowship to H. Grey Verner. Mr. Verner will carry on his work in the chemical engineering department of the L. C. Smith College of Applied Science, where facilities for metal finishing research were established last year.

Mr. Verner comes to Syracuse from Wilmington, Del., where he has been a chemical engineer at the Du Pont experimental station. He is a chemical engineering graduate of the University of Pittsburgh in 1940, where his work earned him high honors. He was a member of the American Institute of Chemical Engineers as a student, and was awarded membership in the national honorary engineering fraternity, Sigma Tau.

## Abbot New Products Division Manager For Penn Salt

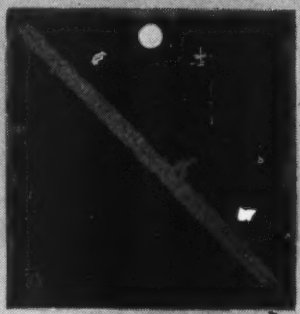
Fred C. Abbott has been appointed Manager of the New Products Division, Pennsylvania Salt Manufacturing Company, Philadelphia. He has been associated with the Market Research and the Sales Departments since joining the company in 1943. In his new capacity he will be in charge of introducing and developing the sale of new industrial chemicals and specialties made available by the Company's research program.

Mr. Abbott brings to his new appointment a broad background of industrial chemical experience, gained by several years spent in chemical and engineering research, production, market research and sales. In establishing this Division, the Company is recognizing the need of industrial and commercial consumers of chemical products for a more specialized service on new chemical commodities.

## New Sales Manager for Keystone Alloys

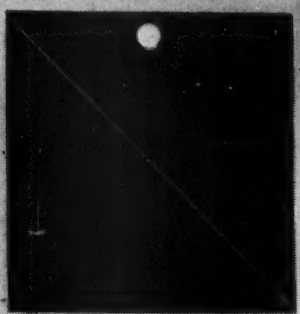
The Keystone Alloys Company, Derry, Pa., announces the appointment of John E. Nipar as Manager of Sales and Distribution for powdered metals and powder metallurgy parts. Mr. Nipar, a graduate of the University of Pittsburgh, was formerly employed in the Metallurgical Department of the Carnegie-Illinois Steel Company at Homestead, Pa.; and was, until his recent appointment, Assistant to the Keystone General Manager.

# Paint Finishes Endure on Properly Cleaned and Conditioned Surfaces



The superior performance of a good paint system on a surface *properly* cleaned and conditioned with 210 B DEOXIDINE.

Even a good paint fails prematurely on a poorly prepared surface as illustrated by the Alkali cleaned panel.



CLEANED with ALKALI

CLEANED and CONDITIONED with 210 B DEOXIDINE

*Identical Salt Spray Exposure*

## CLEAN AND CONDITION SHEET METAL with 210B DEOXIDINE

**THE 210 B DEOXIDINE** process is the simplest and most advanced procedure in metal preparation for paint. A minimum of low-cost operating equipment is required therefore, less than the usual amount of operating space is needed. The fewer necessary operations cut the production costs. Time and labor are saved and better results obtained.

**APPLICABLE TO LARGE METAL PRODUCTION**

210 B DEOXIDINE is ideal for completely mechanized spray process in power spray washers constructed of mild steel. A three stage washer is usually sufficient, but four stages are preferable if drawing compounds are present.

**A NATURAL FOR THE SMALL PRODUCTION PLANT**

210 B DEOXIDINE does not require expensive stainless steel equipment. Three stage washers which have previously been used for alkali cleaning can be used. The simplicity of controls of 210 B Deoxidine bath and process lead to uniformly good results.

**210 B DEOXIDINE** is but one of several war-proved Deoxidines — each created to meet different conditions. ACP Technicians will gladly advise with you and suggest the particular ACP products and processes which will efficiently meet your cleaning and conditioning problems. Write to Dept. N-12.

MANUFACTURERS OF INHIBITORS AND METAL WORKING CHEMICALS

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Van Camp Products & Sales Co.
177 Parliament St., Toronto, Ont.

# NEW Equipment Materials Supplies

## Corrosion Protection for Cadmium and Zinc With One Dip

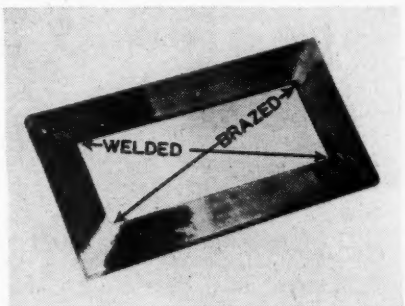
Announcement is made of a new process, Unichrome Dip, offering a convenient and economical means of obtaining corrosion protective coatings on Cadmium and Zinc. By converting the surface to chemically inert compounds, either black or olive drab finishes can be produced which prevent the formation of white corrosion products and also provide an excellent base for paint or lacquer.

An outstanding advantage is that parts require only a single immersion in Unichrome Dip, for from 2 to 5 minutes. Other advantages are that no special equipment, racking or current is required; parts are handled in bulk and treated at room temperature; maintenance and control of the solution is both easy and inexpensive. In addition to being a quick, low cost process, coatings produced in Unichrome Dip offer an unusual degree of protection, preventing the appearance of white corrosion products in the standard salt spray test for periods up to 200 hours. Descriptive folder upon request by writing to United Chromium, Incorporated, 51 East 42nd St., New York 17, N. Y.

## New Method of Removing Flux, and Welding or Brazing Scale Announced by Optimus Detergents Co.

Highly satisfactory results in removing flux, and welding and brazing scale with Optimus Deoxidant No. 3, are reported by its maker, Optimus Detergents Co., 131 Church Street, Matawan, N. J., manufacturers of industrial metal cleaning compounds. It is being used to dexodize the surfaces of a wide variety of metals and alloys.

Not a bright dip, and not intended to replace acid in ordinary pickling, Optimus Deoxidant No. 3 being acidic in nature, is further reported to be used on most metals as a mild deoxidant without serious etching of the surface. It is used regularly on welded steel tubing, brazed, hot rolled and cold rolled steel, copper, brass, welded aluminum, cast iron, bronze castings and most aluminum alloys.




**Welded and brazed joints before and after cleaning with Optimus Deoxidant No. 3.**

In general, oxides are removed with the formation of very little or no smut, in contrast to the smutty surfaces frequently encountered. With the use of Optimus Deoxidant No. 3 most welding and brazing scales are removed in from 5 to 15 minutes. Longer time tends to produce a smut with some alloys.

In using Optimus Deoxidant No. 3, material costs are said to be low, for consumption is largely a matter of replacing drag-out. There are no annoying or corroding fumes.

Ease of operation is provided. It is only necessary to deoxidize for the required time, give work a quick rinse in hot water and the job is done.

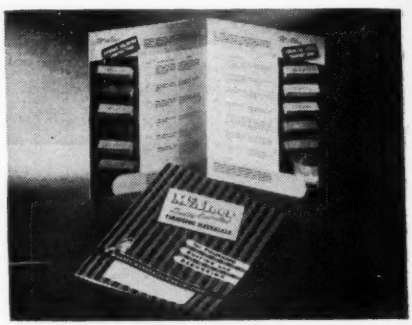
## "Karbate" Sectional Cascade Cooler

"Karbate" Sectional Cascade Coolers, designed for the efficient cooling of corrosive liquids and gases, are now available from National Carbon Company, Inc., N. Y. A complete cooler assembly is quickly and easily erected from four standard items in five pipe sizes and is adaptable to a wide range or process requirements. Construction is such that additional units, or sections, may be added just as one would stack office filing cases.

Having the well known properties of "Karbate" impervious graphite materials such as corrosion resistance, high heat transfer rate, resistance to thermal shock and freedom from corrosion scale formation, "Karbate" Sectional Cascade Coolers are recommended for service in practically all acids, caustics and organic solvents at pressures up to 75 lbs. per square inch and temperatures up to 338°F (170°C). Minor changes in the method of applying the cooling water permits the handling of gases well in excess of this temperature.

Nine feet long, single pipe, "Karbate" cooler sections are stacked to form a series flow vertical bank and are held in place by steel tie rod assemblies which form a rigid supporting structure. Gaskets are furnished in either synthetic rubber or asbestos composition as required. A standard steel water distributor is mounted on the tie rod assemblies and can be accurately adjusted to assure uniform cooling water distribution over the pipe. The compact construction offers close pipe spacing and eliminates the necessity of redistribution baffles. Maximum effective external surface areas of approximately 120 square feet are available in all of the five sizes in the maximum recommended cooler height of six feet. The complete cooler assembly is easily dismantled for the addition or replacement of interchangeable sections.

## Polishing, Buffing & Deburring Manual



The Industrial Finishing Division of the McAleer Manufacturing Company, Rochester, Mich. has just issued a new, illustrated, 24-page industrial finishing reference manual on "Polishing, Buffing and Deburring".

Among the finishing materials listed in this catalog are those old "stand-bys" of pre-war days which have been retained because of proven usefulness and new finishing compositions developed for post-war production finishing needs.

For the man who uses or specifies industrial finishing materials, this booklet tells when and where to use what compositions, summarizes and interprets applications — offers helpful suggestions for present-day finishing of all types of metals, non-metals and plastics.

The McAleer Catalog is free and available to all qualified industrial finishing material users. To secure a copy, write Industrial Finishing Division, Dept. P-1, McAleer Manufacturing Company, Rochester, Mich.

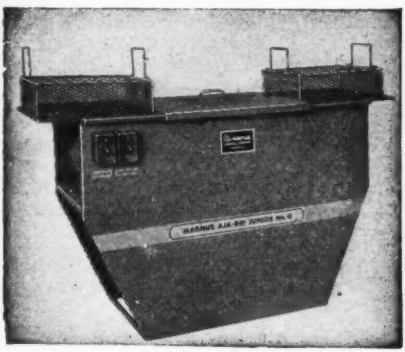
## X-Ray Diffraction

A new 16-page illustrated booklet that covers basic theory, principles and applications of X-ray diffraction has been announced by North American Philips Company, Inc., 100 East 42nd Street, N. Y.

Text material was written by F. G. Firth, Research Engineer and is divided into three sections. Part 1 deals with the basic principles and theory of X-ray diffraction. Part 2 discusses the constitution of matter. Part 3 treats many application problems at considerable length.

In detail, the booklet explains: 1. How X-rays are diffracted. 2. Technique of powder identification. 3. How various types of film-type equipment work. 4. Advantages of the new Geiger-counter X-ray Spectrometer. 5. Low-angle scattering. 6. Particle size and orientation of matter. 7. Alloy formation. 8. Organic compounds. 9. Catalysts. 10. Studies of mineral substances. 11. High polymer work. 12. Petroleum products and 13. Heat exchanger problems.

## New Machine Designed For Small Batch Cleaning



The Equipment Division of the Magnus Chemical Co., Inc., Garwood, N. J., announces a new small machine for cleaning metal parts in production. It is especially suited for metal working shops whose volume of parts to be cleaned does not warrant the installation of expensive, fully automatic cleaning equipment.

The Magnus Aja-Dip, Jr. Cleaning Machine is used in metal working plants for the complete removal of cutting oil and chips, buffing compounds, smut, abrasives or any other deposits resulting from stamping, drawing, cutting, grinding, burnishing or other operations. Parts are handled in batches of 30 to 75 lbs., depending upon the model of the machine. One full batch of parts can be handled ever two or three minutes.

The Magnus Aja-Dip, Jr. cleans by Agitation. The parts to be cleaned are vigorously agitated up and down, seventy-two times a minute, in the cleaning solution. This agitation, plus the action of the cleaning solution, "shears" the dirty deposits from all surfaces of the parts.

The Magnus Aja-Dip, Jr. can be used with any type cleaning compound, alkaline, petroleum spirits, emulsifying agents and chloroniated solvents. It may be used with hot or cold solutions. If heated, heating may be by either electricity or gas.

The Magnus Aja-Dip. is available in two sizes, No. 0 and No. 00. Either of the two models can be supplied with built-in rinse compartments which may also have the agitation feature, if desired.

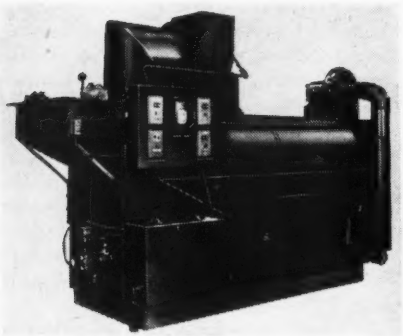
Magnus Bulletin No. 200-AJ completely describes the Aja-Dip, Jr. Cleaning Machine. For your copy, write to: Equipment Division, Magnus Chemical Co., Inc., Garwood, N. J.

## Dipwrap

Because of the protection it affords to finished surfaces against mechanical and corrosion injury coupled with its ease of application, and ease or removal, Dipwrap Resilient Coating will undoubtedly prove of interest to many plating and finishing shops. This war-time product, based on a synthetic organic material, was developed originally to speed up packaging operations for metal products by eliminating the conventional slushing, wrapping and cartoning procedures. Many adaptations of Dipwrap to civilian goods have already been made and the features offered by the material seem to warrant its investigation by manufacturers confronted with packaging problems. Further details may be obtained from Technical Service Bulletin No. 14 which will be sent on request by Paisley Products, Inc., 1770 Canal Port Avenue, Chicago 16, Ill.

## New Rinsing and Drying Machine Made by Optimus Equipment Co.

A new machine especially designed for the rinsing and drying of screw machine or small stamped parts, has been announced by Optimus Equipment Company, 131 Church Street, Matawan, N. J., manufacturers of equipment for the washing, rinsing, pickling and drying of metal parts.



**Optimus Screw-Drum Type Rinsing and Drying Machine**

The Optimus Screw-Drum Type Machine is versatile in its applications. It can be used for washing and drying, or rinsing and drying, or any part of these operations. It is also adaptable to a wash-drain, rinse-drain, cold or hot air dry operation sequence.

Ideal for very difficult rinsing and drying jobs, this equipment can also be adapted for pickling operations. The air stream passes through heater and blower providing for either or both cold and hot air blast system. Air loss is avoided by completely enclosed dryer end.

The various parts of the machine are readily accessible for lubrication, maintenance, or alterations and cleaning such as might be required in hard water areas. Centralized lubrication may be provided.

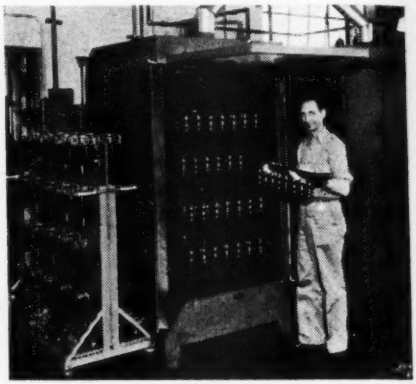
## "All-Purpose" Industrial Oven

New, mass produced industrial ovens, in sizes from 2′x2′x3′ to 4½′x6′x9′, adaptable for all baking and drying processes up to 500°F., are said to speed baking by as much as 50%. The units are self-contained and require only lead-in of gas or electricity for complete installation.

A special loading dolly and shelf arrangement permits easy loading and maximum use. Upright position also means easier loading plus floor space saving. Automatic controls and quick starting make oven readily adaptable from one type of operation to another.

These ovens are now successfully in use on radio and also radar, coil and armature drying and baking, carbon embrittlement and aluminum aging, baking a variety of synthetic finishes, Japans, varnishes, lacquers, enamels, and all kinds of dehydrating and drying.

Special safety features and complete insulation insure comfort and health of workmen. Uniform temperature, high volume air flow, and controlled volatile exhaust assures quality and uniformity of processing, as well as reduction in baking time. Further details available on request from Despatch Oven Co., 619 S. E. 8th St., Minneapolis 14, Minn.

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# Nickel Plating Symposium

## January 19, 1946

*at the*

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This timely and full educational session under auspices of the Chicago Branch will have as its guest of honor the distinguished Dr. O. P. Watts.

★ ★ ★

**SPEAKERS and SUBJECTS**

| | |
|---|---|
| V. MATTACOTTI | — Cold Nickel Baths and Soft Deposits |
| W. M. PHILLIPS | — Watts Type Nickel Bath |
| B. MARTIN | — Organic Type Bright Nickel Baths |
| M. DIGGIN | — Alloy Type Nickel Baths |
| DR. W. A. WESLEY<br>W. L. PINNER | — High-Speed Dull and Bright Nickel Plating |

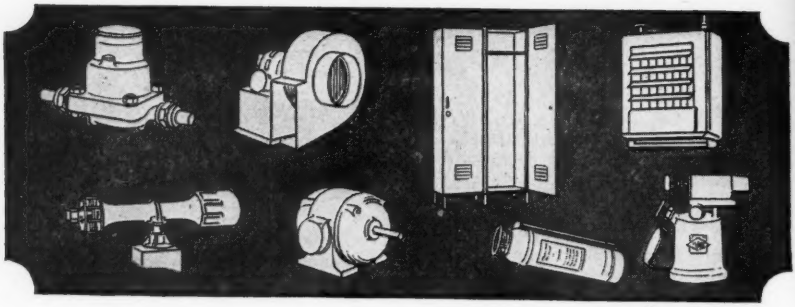
★ ★ ★

This program which starts at 2:00 P. M. will be followed with a banquet and entertainment in the evening. Hotel reservations should be made as soon as possible and certainly not later than December.

***Secretary-Treasurer Chicago Branch***

**M. H. LONGFIELD**

**1528 S. 61st Avenue** **Cicero 50, Illinois**



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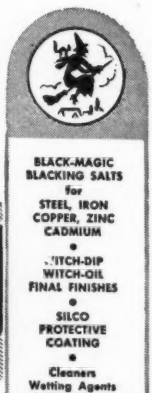


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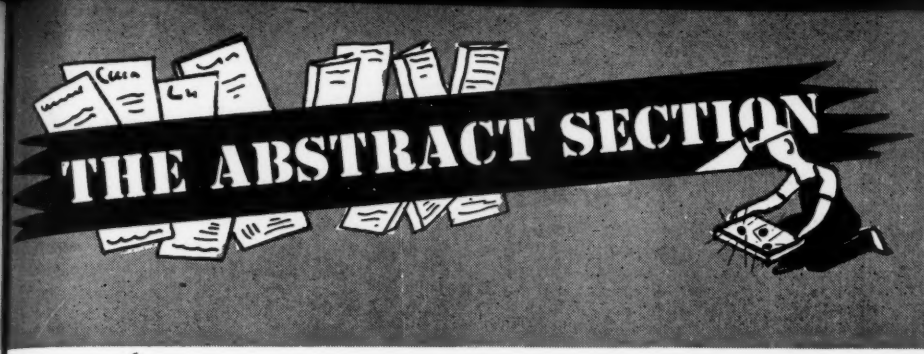


**FRANK K. SAVAGE**

*Chairman, Program and Educational Committee*

### Corrosion in the Tropics

By GEORGE W. GRUPP. *Metal Finishing*, **43**, 326-8, (1945).

Corrosion in the South Pacific has been much more intense than originally expected by the Military. Reasons are: the presence of ammonia producing micro-organisms, sea water spray and coral sand-blast whipped up by hurricanes and typhoons, periodic oceanic eruptions containing hydrogen sulphide, sulphur compounds of other volcanic origin, high humidity and temperature which release organic acids and other corrosive products from wooden containers, dunnage and other hygroscopic materials. A summary of the packaging methods developed by the Armed Services during the war is given.

R. B. KINNAMAN

### Wearing Qualities of Gold Deposits

By GEORGE G. HOGABOOM. *Metal Finishing*, **43**, 329-30 (1945).

Abrasion tests with the Taber Abraser using No. 10 Kalibrase wheels, refaced after each 200 cycles of wear, 1000 gram weights per wheel, gave the following results:

| *Coating* | *Thickness, In.* | *Mg. Loss per 1000 cycles* |
|---|---|---|
| Gold | 0.00016 | 62 |
| Gold | 0.00007 | 57 |
| Gold | 0.00001 | 43 |
| Lacquer No. 1 | 0.001 | 25 |
| Lacquer No. 2 | 0.001 | 57 |

It is concluded that heavy gold coatings are softer than light coatings, that a good lacquer has twice the wear life of a poor lacquer, and that a 0.00001 in. gold coating with good lacquer has better service life than a heavy gold coating with poor lacquer. Advice is given to gold platers who commonly apply extremely thin coatings for costume jewelry and the like, on plating methods necessary to meet Government specifications requiring 0.0002 in. gold on medallions, medals and similar articles.

R. B. KINNAMAN

### Electrodeposition of Silver and Copper from Their Simplest Salts

By A. LEVIN. *J. Phys. Chem., USSR*, **18**, 53 (1944); Abstract in *Metal Finishing* **43**, 330 (1945).

Experiments with $5x10^{-6}$ to $4x10^{-10}$ normal silver nitrate and $10^{-7}$ to $2.5x10^{-12}$ normal copper sulphate at current densities less than 0.2-2 amp./sq. ft. gave microcrystalline coatings which did not flake off on bending the cathodes. Current efficiencies were 15-30%. The coatings are similiar to those obtained from complex oxalate and cyanide solutions.

R. B. KINNAMAN

### Analysis of Hydrofluoric-Nitric Acid Stainless Steel Pickling Bath

By WILLIAM C. McKEE and WILLIAM F. HAMILTON. *Metal Finishing*, **43**, 332-33, 339.

Rapid quantitative analytical procedures are presented for the determination of total acidity, iron, fluoride, and nitrate.

R. B. KINNAMAN

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### Salt-water Corrosion on Plated and Unplated Stainless Steels

C. J. STRID. *Product Eng.* **16**, 398-9 (1945).

Tests prove conclusively that cadmium plating of steels 416 and 440 is unnecessary. Passivity, effected by dipping the metal in an acid of correct strength and temperature, is important in resisting corrosion in 416 and 440 steels. In the active state, the alloys are readily subject to galvanic action, but they are extremely stable in the passive condition. Local temperature differences set up local electrolytic cells. Intergranular corrosion in chromium alloys is the result of improper heat treatment. The effect of air was small compared to that of saline solution. Salt solutions usually carry enough air to maintain the required oxide film and to keep the surface in its passive condition. Photographs of test specimens are shown.

A. N. HIRD, *Chemical Abstracts*

### Influence of Surface-Active Substances and Inorganic Salts on Orientation of Crystallites in Copper Coatings

S. P. MAKAR'EVA. *J. Phys. Chem.* (U.S. S.R.) **17**, 169-71 (1943).

Electrodeposits of copper from molar copper sulphate (33 oz./gal.) and 0.5 molar sulphuric acid (6.5 oz./gal) are oriented along [110] at low and [112] at high current densities. At low current densities iso-amyl alcohol, pyridine, and furfuraldehyde do not affect the orientation; pyridine and furfuraldehyde prevent the orientation along [112] at high current densities.

B. A., *Chemical Abstracts*

### The Final Rinsing Operation in the Chemical Surface Preparation of Alclad 24S-T for Spot Welding

R. A. WYANT, D. J. ASHCRAFT and T. B. CAMERON. *Welding J.* (N.Y.) **24**, 361s-9s (1945).

A reaction takes place between the freshly treated surface of Alclad 24S-T sheet and the final rinse water employed in preparing the sheet chemically for spot welding. When the reaction occurs, the contact resistance increases rapidly with increasing rinsing time and water temperature and tends to cause poor electrode-tip life and other welding difficulties. The rate of reaction depends on both the composition of the surface treating solution and of the rinse water. The reaction occurs in the distilled water and in distilled water containing appreciable amounts of bicarbonate, chloride, sulphate and nitrate ions. The reaction can be prevented by reducing the pH of the water with sulphuric acid to a value of 3.0 for material heat treated in an air furnace and to 4.0 for material heat treated in a nitrate salt bath.

J. W. PERRY, *Chemical Abstracts*

### The Electrodeposition of Element 43 and the Standard Potential of the Reaction Ma — $MaO_4^-$

JOHN F. FLAGG and WM. E. BLEIDNER. *J. Chem. Phys.* **13**, 269-76 (1945).

The element can be obtained in an oxidized, anionic form by treatment with nitric and sulphuric acids. It can be deposited electrolytically on a platinum cathode, the reduction to the metal very probably being the principal process. No anodic deposition (comparable to manganese dioxide) is observed. The deposition potential for the metal from its anionic form is $^-0.146$ volt vs. the normal hydrogen electrode in a solution of pH 2.36. This corresponds to a standard electrode potential of $^-0.41$ volt for the process: $Ma + 4H_2O = MaO_4^- + 8H^+ + 7e$. The anionic form of the element is reduced and removed from solution by metallic zinc, iron, nickel, tin, lead, copper, and mercury. Hydrochloric acid and stannous chloride reduce the anion to a cation.

G. M. PETTY, *Chemical Abstracts*

### Diffusion Layers of Chromium on Iron and Steel

N. S. GORBUNOV. *J. Applied Chem.* (U.S.S.R.) **17**, 495-501 (1944) (English Summary).

Iron and steel were heated with powdered chrome-silica gel mixture plus 2% ammonium chloride in the presence of hydrogen. The chromium layer formed varies in thickness depending on duration

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and temperature of treatment. This treatment permits heat-working of the article and improves its resistance to corrosion.

G. M. KOSOLAPOFF, *Chemical Abstracts*

### Bright Galvanizing

R. I. KAUFMANN. *Sudostroenie* **11**, No. 8, 344 (1941). *Chem. Zentr.* **1941, II,** 1791.

A bath containing 4.7 oz./gal. zinc oxide, 13.3 oz./gal. sodium cyanide, 13.3 oz./gal. caustic soda, 0.067 oz./gal. sodium sulphide, and 0.67 oz./gal. glycerine is used for bright galvanizing of iron objects. A dense shiny zinc coating is obtained in this bath at room temperature with a current density of 65 amp./sq. ft. The coating is made still brighter by subsequent dips in 4% nitric acid and 18% chromic acid solutions.

H. J. KANDINER, *Chemical Abstracts*

### Analysis of Silver Plating Solutions A Simple Electrometric Method

J. N. GREGORY and R. R. HUGHAN. *Ind. Eng. Chem., Anal. Ed.* **17**, 109-13 (1945).

The estimation of free cyanide and silver cyanide in silver plating solutions can both be performed electrometrically from one run of a buret, by means of the following reactions: (1) $2KCN + AgNO_3 = KNO_3 + KAg(CN)_2$, and (2) $KAg(CN)_2 + AgNO_3 = KNO_3 + Ag_2(CN)_2$. The inflection potentials at the end point are approximately zero and $-0.21$—$-0.22$ volt respectively, against the saturated calomel electrode, and a change of about 50 millivolt results from the addition of 0.1 normal silver nitrate solution when the pH has been adjusted to 5.0 by saturation with boric acid. The method is rapid and easily performed; the accuracy is satisfactory. Interfering ions are not likely to be present.

L. A. SARVER, *Chemical Abstracts*

### What is a "Clean" Surface?

ERNEST H. LYONS, JR. *Trans. Electrochemical Soc.* **88**, 10 pp (Preprint) (1945).

Only rarely, if ever, does a metal article to be plated enter the electroplating bath with a truly clean surface, even after careful cleaning. Films on the surfaces to be plated are classified according to the effects on the electroplate. In electrodeposition a surface is required which will receive a smooth, adherent metal deposit, but this is not necessarily an absolutely clean surface. In general an acceptable surface is one on which "objectionable surface films have been replaced by films more suitable and acceptable for electroplating."

A. K. GRAHAM, LEONARD E. WEEG

### Wire, Gold Braid and Military Insignia

R. LEVI. *Wire and Wire Products* **20**, 559-62 (1945).

A description of the development of a new industry and the different manufacturing processes. Wires with a silver finish, with a gold finish, mechanical cladding, electrodeposition, drawing of clad wire are all discussed. A continuous process for plating molybdenum and tungsten wire to overcome secondary emission in electron tubes has been developed.

W. H. BOYNTON, *Chemical Abstracts*

### Peacetime Plating

R. MACNAIR. *Metal Ind.* (London) **67**, 74, 106, 139 (1945).

The problems awaiting the plater on return to peacetime decorative plating are: The overhauling of plants since most of the pre-war plants are in derelict condition, and the lack of skilled operators with reeducation of those available.

Improved and modern equipment layouts for warm and bright nickel solutions are described. Cycles for nickel plating steel, brass, zinc base and soldered articles are given.

An unusual chromium bath is mentioned, consisting of: $CrO_3$, 64 oz./gal.; $SO_4$, 0.7 oz./gal.; $Cr^{+++}$ and $Fe^{++}$, 3.5 oz./gal. each; temperature 98° ±2° F.

L. W. MORSE

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BECAUSE one little leak in a lead-lined acid-tank can be so costly in down-time and repair expense, preventive maintenance in the form of long life construction is a common-sense form of profit protection. The Storts specification for welding lead linings is insurance at its best, because it actually prevents failures from happening. For every lining thickness there is a standard procedure which includes enough build up to make certain that the weld deposit will be the *last* place where acid attack can get through. The extra life makes Stortswelded construction a bargain. Phone Meriden 5800 for a quotation on your next requirement.

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## GRAND RAPIDS BRANCH

The fall season started off with a bang with our meeting on September 17 at the Rowe Hotel. Fifty-three members and guests were present to hear Mr. J. E. Bunch of General Motors Corp. present a timely and very instructive paper on "The Plating Rack as a Tool." He covered design and function, materials of construction including rack coatings, and use and care of racks, pointing out the importance of proper handling of racks and precautions to be observed. His paper, well received by the audience pointed up many of the economical practices which may have been forgotten or overlooked in the rush of war work.

Our newly elected Branch President, Stewart Martin, announced that he was leaving Grand Rapids to assume new duties elsewhere and therefore was relinquishing his office to James A. Badaluco, our First Vice President. The Branch regrets losing "Stew" especially after just congratulating itself on getting him back from Detroit where he had been for the past two years. We wish him success in his new work.

RANSOM B. PERKINS, *Secretary*

## GRAND RAPIDS BRANCH

Grand Rapids Branch held its monthly meeting on October 12 at the Rowe Hotel. We were singularly favored by having Walter L. Pinner, President of A.E.S., present his now famous Gold Medal-winning paper on "High-Speed Nickel Plating", which opened the eyes of the audience to the vast possibilities offered by the new high-speed chloride bath. We all enjoyed Mr. Pinner's address and were honored to have him with us.

President James A. Badaluco announced a membership drive and appointed Christian M. Fernekes as Membership Committee Chairman. Jacob M. Hage was appointed Exhibits Chairman in preparation for the Branch's exhibit at the coming June Convention. The date of the Branch's Annual Educational Session and Banquet was announced as January 26, 1946. Both events will be held at the Pantlind Hotel. Committee chairmen for the session and banquet were appointed.

Five new members were elected to memberships and welcomed into the Society.

RANSOM B. PERKINS, *Secretary*

## MILWAUKEE BRANCH

The Milwaukee Branch held its regular meeting on September 7 at the Wisconsin Hotel. Mr. Downey of the General Electric Company gave a very informative talk on rectifiers. He compared the efficiencies and performances of rectifiers and generators and pointed out their respective advantages.

Mr. William Geissman has planned a refresher course in electroplating. The meetings will be held on five consecutive Monday nights beginning Nov. 12th, at the Marquette Engineering Building.

The meeting ended with Mr. Vincent Mattacotti offering a $5.00 prize for the solution to a pitting problem he encountered in his bright nickel work.

JAMES DURNFORD, *Secretary*

## MILWAUKEE BRANCH

The October meeting of the Milwaukee Branch was held on October 5 at the Ambassador Hotel. The detailed business was taken care of by the officers. President Geissman described the program planned for our refresher course in electroplating. He then turned the meeting over to Librarian Ted Hartshorn who brought up the discussion subject for the evening: Cause of and cure for pitting in a bright nickel

solution. Since no cure was found the $5.00 offered by Mr. Mattacotti was placed in the "kitty".

Mr. Hartshorn then introduced Mr. Temm who showed slides and portrayed beautiful scenes of Milwaukee and vicinity. "Diamonds in Your Own Back Yard" aptly describes these seldom noticed beauties within walking distance of Milwaukee. Mr. Temm was given a rising vote of thanks. The presence of the wives at this meeting made it an unusual affair since they have never before attended a regular meeting. A buffet lunch was served.

JAMES DURNFORD, *Secretary*

## CHICAGO BRANCH

The regular monthly meeting was held on November 9 at the Hamilton Hotel. President Paul Krause called the meeting to order with all officers present.

The business session was enlivened with reports from the various committees.

Librarian C. W. Carter introduced Dr. R. B. Saltonstall of the Udylite Corporation, Detroit, Mich., who spoke on "Engineering for Bright Nickel Plating". In the lengthy and lively discussion which followed, Dr. Saltonstall developed some very interesting answers. A rising vote of thanks was given for a good talk, very well presented.

M. H. LONGFIELD, *Secretary*

## TOLEDO BRANCH

The regular meeting was held on October 4 in the office of the Victor Miner Co.

The meeting was opened by President Allison with 20 members present. It was decided to ask Mr. Merz of the Harshaw Chemical Co., Cleveland, Ohio, to give a talk on "Bright Nickel" at the November meeting, and Mr. Bunch to talk on "Standards" at the December meeting.

Mr. Allison reported that Mr. Marion Ely who recently became a member of our Branch had entered military service.

Mr. Allison then introduced Mr. B. F. Lewis of the Northwest Chemical Co., Detroit, Mich., who gave a splendid, informal talk on "Cleaners and Cleaning Methods" and answered many questions pertaining to cleaning. His remarks were very well received and the Branch extends many thanks to Mr. Lewis for a very informative evening.

G. BERGEMAN, *Secretary*

## HARTFORD BRANCH

An open meeting was held on October 15 at the Hotel Garde. After dinner had been enjoyed by 20 members and guests the educational session with an attendance of 45 was called to order by President Harry Sanders. George Hogaboom was the "answer man" at the session which had for its subject "A Symposium on Plating Problems". Before he tackled the questions he treated the audience to an informal discourse on general finishing problems, and drawing on his voluminous experience he related several stories that delighted his listeners. The following are some of the questions submitted and the answers given:

Q. 1: What is the purpose of copper in a copper-silver strike if copper does not deposit? — A. The copper changes the single potential. Thus you get electrochemical before chemical deposition.

Q. 2: What is an efficient chemical method of removing chromium from a zinc die cast knob? — A. Use strong sulfuric acid anodically. During stripping a yellow chromate film develops which disappears as chromium is removed. An excess of water is to be avoided.

Q. 3: Is nickel followed by chromium directly on the same racks practical? — A. Yes, providing racks are stripped thoroughly after the chrome plating cycle. However, extreme care should be taken to avoid dangers from contamination. The perils involved cannot be stressed too strongly.

After a rising vote of thanks to George Hogaboom for a fine evening, the meeting adjourned to the refreshment stand where beer and pretzels were enjoyed by all.

F. W. SMITH, *Secretary*

## CLEVELAND BRANCH

The first meeting of the fall season was held on September 7 at the Cleveland Hotel with 75 present. Five applications for membership were read, and two candidates were elected to membership.

Charles Ott reported on the very successful July picnic, and Delegate Ralph Schaefer gave his report on the June Business Meeting in Pittsburgh. The Award Committee selected G. J. Berry's paper on "Motor Generators" as the best paper presented at last year's Branch meetings. A plaque will be given to Mr. Berry.

Librarian Schaefer announced a Joint Meeting with the local section of the Electrochemical Society on September 22 at which a symposium on "Modern Metal Protection" will be held.

Librarian Ralph Schaefer introduced the speaker, Mr. B. C. Case of the Hanson-Van Winkle-Munning Company, whose subject was "Bright Nickel". He spoke of the wide variations in prewar results and showed how the lessons learned during the war would aid in producing better and more uniform coatings. Maintenance and purification of the bath were also discussed. A good question period followed.

HARVEY P. HEIL, *Sec'y-Treasurer*

## CLEVELAND BRANCH

The regular monthly meeting was held on November 2 at the Cleveland Hotel with 65 present.

Librarian Ralph Schaefer introduced Dr. C. L. Faust of Battelle Institute who spoke on "Electropolishing". He thoroughly covered the fields of application and enhanced his talk by showing interesting slides and numerous samples. Electropolishing is not considered practical for all polishing work, and is not as yet commercially applicable on all metals. It is often used to brighten rough surfaces. Generally its best application is on parts having complicated and irregular surfaces which are difficult to finish by mechanical methods.

One new application was read and five new members were elected.

Ralph Schaefer outlined the plan for the proposed Engineers' Building in Cleveland. The Branch approved backing this project, without financial obligation.

HARVEY P. HEIL, *Sec'y-Treasurer*

## BALTIMORE-WASHINGTON BRANCH

The November meeting was held on Nov. 6th at the Telford Buffetaria in Washington with 34 members and guests present.

Following dinner, Vice President Brenner announced the glad news that due to new business connection with the Rustless Iron & Steel Corp. of Baltimore the active leadership of Ken Huston would still be available to the Branch. The plans outlined by Chairman Davey for the Annual Banquet were approved. The Branch voted in favor of the amendment to the Newark Branch Amendment on sustaining membership, as outlined in the October REVIEW. Four new members were elected and one application was received.

Librarian Olson introduced A.E.S. Executive Secretary Dr. A. K. Graham, who fluently proved that bigger and better things lie ahead for the Society. At the end of the talk which carried an appeal for past copies of the REVIEW, Fred Pierdon donated his complete collection.

ALBERT G. TAYLOR, *Sec'y-Treasurer*

## TWIN CITY BRANCH

The following officers were elected for the year 1945-46: President, Paul W. Felt; Vice President, G. W. Lillicrop; Secretary-Treasurer, Robert L. Buckley; Librarian, Ralph A. Bowman; Board of Managers, Paul A. Craig, B. J. Rosenthal and N. J. Garvey.

ROBERT L. BUCKLEY, *Secretary*

## TWIN CITY BRANCH

The Twin City Branch met November 5 at the Covered Wagon's Lodge Room in Minneapolis with 35 members and guests present.

President Paul W. Felt appointed an Exhibits Committee to prepare for the 1946 Annual Convention, consisting of Gunnar Deedon, Chairman, Jerome M. Weller and Frank E. Revell. E. H. Lindemann will head up the Research Fund Committee with R. M. Krieger and Robert L. Buckley assisting.

Membership Committee Chairman G. W. Lillicrop welcomed one new member to the Branch.

Librarian R. A. Bowman introduced Mr. J. Gerber of Turco Products who spoke on "Surface Chemistry", stressing what constitutes good cleaners and how to control them.

The only disconcerting event of the entire evening was the fact that our Librarian R. A. Bowman, Metallurgist with Superior Plating & Rustproofing, won the door prize, a bottle of Seagram's, donated by Mr. Leo Demars of Superior Plating & Rustproofing.

ROBERT L. BUCKLEY, *Sec'y-Treasurer*

## GRAND RAPIDS BRANCH

The November 9 meeting started with the showing of a short movie, which included pictures taken on European battlefields and an interesting nature film.

Maurice R. Caldwell explained the Newark Amendment, and the Branch voted to support it.

Two new members were elected.

Plans for our Annual Educational Session and Dinner Dance, to be held on January 26, 1946, at the Pantlind Hotel, are well under way. We are trying in every way possible to make this year's affair comparable to the preceding ones in both technical excellence and entertainment.

Mr. William Jackson of the Udylite Corporation spoke on "Barrel Plating Equipment and Its Arrangement". He dwelt on the principles which make for good arrangement and efficient operation of barrel plating departments. The value of mechanical aides such as mono-rail hoists and transfer chutes was pointed out, as well as the reasons for such details as right to left flow of operations. Mr. Jackson's paper was well received by the members, as evidenced by the discussion which followed.

RANSOM B. PERKINS, *Secretary*

## NEW HAVEN BRANCH

The regular monthly meeting held on October 2 in the Sterling Chemistry Laboratory, Yale University, opened with a sound-technicolor film "Arc Welding, the Magic Wand of Industry", shown through the courtesy of Lincoln Electric Company.

Librarian Dr. H. L. Kellner presented our new Executive Secretary, Dr. A. K. Graham who spoke convincingly of the plans for improving the Society and THE MONTHLY REVIEW and the advancements being made through the Research Projects. Dr. Graham was pledged the full cooperation of the Branch.

B. J. GAFFNEY, *Sec'y-Treasurer*

## NEWARK BRANCH

Fifty odd including all officers were present at the November 2 meeting.

One application was received.

Howard L. Cobb reported the completion of the Year Book and was thanked for all his work. The Year Book had been mailed to all members of all Branches. Horace Smith reported that everything was set for our Christmas Party scheduled for December 15, 8 P.M., at Hotel Robert Treat.

Mr. Maher, President of the New York Branch, who attended with several New York Branch members, invited the Newark Branch to attend the New York Branch Banquet on February 23, 1946.

William F. Hodecker, Sr. and Edward W. T. Faint were elected to Honorary Membership of Newark Branch.

Our speaker for the evening, Mr. Ed Rinker of Bart-Messing Corporation, had for his subject "Heavy Nickel Deposits". He exhibited numerous samples with nickel thicknesses of up to 0.080 in. Their rough and dark appearance was said not to matter in view of the service requirements.

GEORGE WAGNER, *Secretary*

## SPRINGFIELD BRANCH

The October 29 meeting at the Hotel Charles was called to order by ex-President Hastie.

One application for membership was accepted.

Librarian Frank Clark introduced Mr. Irving Niles who introduced the speaker, Mr. K. R. Longnecker of the Zapon Division of the Atlas Powder Co. His talk on "Trends in Organic Finishing" was a synopsis of the current material situation and a discussion of various finishes and baking methods. Infra-red baking has definite limitations. Induction baking is now beyond the experimental stage. A short question and answer period followed.

PAUL F. LYMAN, *Sec'y-Treasurer*

## SYRACUSE BRANCH

The first regular monthly meeting of the season was held on September 14 in Bowne Hall, Syracuse University.

President Murphy turned the meeting over to Librarian D. M. Overcash. He introduced Mr. R. R. Bair of E. I. du Pont de Nemours & Co., who gave an interesting talk on "Recent Researches on Cyanide Zinc Plating", followed by a discussion period.

NEIL C. MOFFEI, *Secretary*

## SYRACUSE BRANCH

At the October 12 meeting in Bowne Hall, Syracuse University, President Murphy announced the appointment of the following Research Committee: Ben Rensin, Chairman; George Simmons, Austin Fletcher and Dr. N. F. Murphy. George Cavanaugh was appointed Exhibits Chairman.

There was one election to membership.

Librarian D. M. Overcash introduced Mr. B. C. Case of the Hanson-Van Winkle-Munning Co. who discussed "Purification of Nickel Baths and the Handling of Bright Nickel Solutions".

A lively discussion followed this interesting and informative talk.

NEIL C. MOFFEI, *Secretary*

## WATERBURY BRANCH

The usual dinner opened the October 12 meeting at Hotel Elton. Three applicants were elected to membership.

George Dupernell, technical chairman for the evening, presented Jacob Hyner who reviewed a paper on "Influence of Ultra-Sound Waves on Electrodeposits of Copper and Zinc" by Th. Rummel and K. Schmitt. Supersonic waves coarsened the plate from acid solutions.

Henry Strow told us about continuous purification of nickel plating solutions for plating of brass and die castings by means of circulation through an auxiliary tank with dummy cathodes in which metallic impurities are plated out at low current density.

The sound and technicolor movie of the evening, "Magic Wand of Industry — Arc Welding", shown through the courtesy of the Lincoln Welding Company, portrayed the amazing results obtained in production welding with this construction tool.

Mr. A. E. Carlson of General Chemical Co. spoke on "Lead-Tin Alloy Plating." He described in considerable detail methods of obtaining lead-tin alloys of specified composition from the fluoborate plating bath, and enumerated several uses, among them the plating of pistons for wear resistance and of radio parts for ease in soldering. Mr. Carlson then answered numerous questions.

S. L. HENN, *Secretary*

## LOS ANGELES BRANCH

Fifty-five members and eight visitors were present at the October meeting.

D. N. Eldred gave a talk on "The Potassium Copper High Speed Plating Bath".

Seven applications were received.

Mr. Rynkofs brought up the subject of the Board of Education reviving the Chemistry Class for platers. Mr. Lamoureaux announced the renewal of his award for the best Branch paper. The sames judges are to officiate as last year. Chief Warrant Officer Stoughton of the Los Angeles Branch announced that the El Toro Marine Base was converting to Civil Service and wanted competent platers.

FRANK J. BUNKER, *Sec'y-Treasurer*

## LOS ANGELES BRANCH

Seventy-six members and fifteen visitors attended the November meeting at the Cabrillo Hotel.

H. P. Curtis, Coast Manager of the Rustless Iron & Steel Co., spoke on "Electrolytic Polishing of Stainless Steel".

Ten new members were elected and four applications were received. Mr. Lamoureux was appointed chairman of the Branch committee to obtain sustaining members, to be aided by John Beall, D. N. Eldred, and Howard Woodward.

Our Delegate was instructed to vote "No" on the Newark Amendment.

On Mr. Rynkofs' announcement that the Chemistry Class can be resumed at Polytechnic High School, beginning January 8 with meetings on Tuesday and Thursday, 6:30 P.M. to 9:30 P.M., 17 members signified their intention to attend.

The death of Harrie Pierce's wife was reported.

FRANK J. BUNKER, *Sec'y-Treasurer*

## BRIDGEPORT BRANCH

Forty-one members and guests attended the October 5 meeting.

William Ehrencrona and Ray Kwasnik

gave a final report of the successful September 29 outing. The Branch expressed its deepest regret at the passing of Miller Barnes, son of Thomas M. Barnes and brother of Thomas M. Barnes 3rd, members of the Branch. Clarence Brown is now on the way to complete recovery from his illness.

F. B. Gotthardt reported one application for membership. Two members requested transfers, one was suspended for non-payment of dues.

R. J. O'Connor, Second Supreme Vice President, in a letter congratulated the Branch for winning last year's Group II prize for enrolling the most new members and asked for continued cooperation and effort.

Dr. F. A. Lowenheim, Chairman of the Electrodeposition Division of the Electrochemical Society, invited the Branch to the plating symposium held on October 24 in New York City.

President H. C. Brown appointed C. C. Helmle chairman of a committee to formulate a program and promote a campaign to obtain Sustaining Members.

Librarian Helmle conducted a "question and answer" period which turned into a regular bull session enjoyed by all.

JOSEPH G. STERLING, *Sec'y-Treasurer*

## BRIDGEPORT BRANCH

An open meeting and Educational Session was held on October 19 with 47 members and guests present.

Librarian C. C. Helmle introduced Mr. Ralph H. McCahan of the Electrochemical Division, E. I. du Pont de Nemours & Co. who, drawing on his wide experience, spoke on "High Speed Copper Plating" and answered many questions during the discussion.

JOSEPH G. STERLING, *Sec'y-Treasurer*

## PHILADELPHIA BRANCH

The regular October meeting was attended by 45 members and guests. Following the dinner President Zurbach introduced Third Supreme Vice President Kenneth Huston who spoke about the activities of the Society and the Exhibition at the 1946 Pittsburgh Convention. The Branch promised a sizeable Branch display.

Librarian Hirsch then introduced K. G. Soderberg of Graham, Crowley & Associates, Jenkintown, Pa. who spoke on "Specifications in Electroplating". The talk covered the intra-relation of performance, process and material specifications, as well as standard test procedures and went into some detail about sampling for testing and engineering requirements.

Phillip Uhl an Honorary Member of both the Supreme Society and the Philadelphia Branch was reported sick for several months at his home, 2352 — 78th Avenue, Philadelphia 38, Pa.

There were two applications, one election and one transfer to the Branch.

PAUL MENTZER, SR., *Secretary*

## BOSTON BRANCH

The Boston Branch met at Hotel Statler on November 2 with Vice President Callahan presiding. There were one election and four applications for membership. The Newark Branch Amendment was approved and Louis V. Gagnon was elected alternate to sign the letter ballot.

Because of the resignation of President Magnuson who is attending college in Indiana, 1st Vice President E. D. Callahan was advanced to President, 2nd Vice President Louis V. Gagnon to 1st Vice President and Edmund Jevely was elected to 2nd Vice President for the balance of the term.

Librarian L. A. Chesworth introduced Mr. Fremont Scott, Development Manager for the Organic Coating Division of United Chromium, Inc. who spoke on "Protective Rack Coatings". His talk covered surface preparation before coating, coating methods and methods for testing coating materials. Mr. Scott passed around samples and answered all questions put to him during the discussion.

ANDREW W. GARRETT, *Sec'y-Treasurer*

## ST. LOUIS BRANCH

At the regular meeting and dinner held on October 10 at the York Hotel an invitation was received from the Engineers'

Club to attend a meeting at Soldon High School on October 18. Mr. O. Dingledein made a report on the Research Fund. He plans to contact additional firms. The Branch voted to stand the necessary mailing expenses.

To increase the attendance at meetings, Mr. Musick suggested that members be contacted by phone. He promised to approach some employers who, he was certain, would be willing to pay membership dues for their men.

Mr. Robbins announced that the subject for the next meeting would be "Generators". Mr. Vogt suggested for a future subject "Health Hazards in the Plating Room". Mr. Robbins then introduced Mr. George Rueter who gave an interesting talk on "Heavy Deposits of Nickel" and showed samples. A lively question period followed.

C. T. McGINLEY, *Secretary*

### DETROIT BRANCH

One hundred and ten members were present at the November 2nd meeting, at which 28 were elected to membership.

Program Chairman, Kenneth Wall of Ford Motor Company, presented Mr. Myron B. Diggin of Hanson-Van Winkle-Munning Company, who talked on "The Purification of Plating Solutions".

Future programs include talks by Mr. William Jackson of the Udylite Corp. at the January meeting and Mr. W. B. Stoddard of the Champion Paper and Fibre Company, Hamilton, Ohio at the February meeting.

GEORGE A. PILLSBURY, *Publicity Director*

## Chicago Dodge Plant Men Take New Positions

Dr. J. H. Monawick, formerly Supervisor of Finishing and Chemical Engineering Operations, has been transferred to the Engineering Laboratories of the Chrysler Corp., Detroit.

William Newberg, formerly Chief Engineer, has been transferred to the Work Administrative Staff of the Chrysler Corp. in Detroit.

King Clifford, formerly in charge of electroplating, is now Plant Manager at the Knight Plating Company in Detroit.

## John S. Hart Moves To Miller-McCluskey

John S. Hart has resigned from the Engineering Division of the Chrysler Corp. in Detroit and is now located with the Miller-McCluskey Plating Corp., Jackson, Mich.

## A. W. Hothersall Visits the U. S.

One of the foremost men in the electroplating field in England, Mr. A. W. Hothersall, is now visiting the U. S. He attended a recent meeting of the Electrodeposition Division of the Electrochemical Society and took a valued part in the discussion. He is also expected to attend the Annual Educational Session and Banquet of the Detroit Branch.

Mr. Hothersall, who obtained his M.Sc. Tech. degree in applied chemistry and metallurgy at the University of Manchester, has done important work on high speed steel alloys before he was put in charge of electrodeposition work at the Royal Arsenal in Woolwich, England. He is well known for his studies of adhesion of electrodeposited coatings, repair work with heavy coatings of nickel and chromium, etc. He is a Past President of the Electrodepositors' Technical Society.

The A.E.S. wishes him a hearty welcome.

## Correction

We take pleasure in adding the name of Ontario Steel Products Co., Ltd., Chatham, Ontario to the October list of A.E.S. subscribers to the research fund. Their check for $25.00 of February, 1945, was deposited by mistake in the funds of a Branch of the Society.

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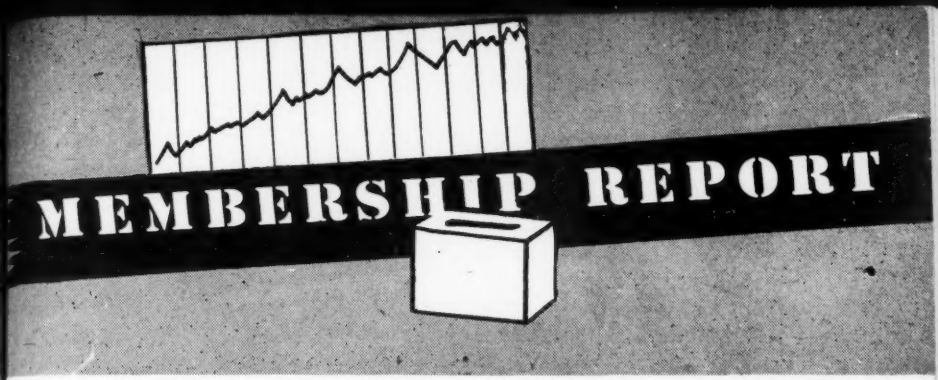


## RAYMOND J. O'CONNOR

*Chairman, Membership Committee*

### ELECTIONS

***Montreal Branch***

William L. F. Glover, 754 2nd Ave., Verdun, Quebec, Canada

***Sydney Branch***

R. V. Fitzgerald, c/o 197 Catherine St., Leichardt, N.S.W., Australia

A. Cornell, 13 Girraween St., Kingsgrove, N.S.W., Australia

G. Bailey, 30 Park Rd., St. Peters, N.S.W., Australia

R. G. Pope, 5 Datchett St., East Balmain, N.S.W., Australia

A. F. Forbes, 35 Wyralla Ave., Epping, N.S.W., Australia

G. L. Rose, 415 Glebe Rd., Glebe, N.S.W., Australia

Norman H. Kent, Walder Rd., Liverpool, N.S.W., Australia

Hector J. Bailey, 28 Robertson St., Campsie, N.S.W., Australia

Annie W. Nicholson, 112 Redfern St., Redfern, N.S.W., Australia

Albert S. Cunnington, 37 Wansey Rd., Randwick, N.S.W., Australia

Robert Lamberton, 61 Fairview St., Arncliffe, N.S.W., Australia

Kurt J. Hacker, 180 Commonwealth St., Sydney, N.S.W., Australia

William MacD. Hall, 2 Waratah St., Chatswood, N.S.W., Australia

Charles Hughes, 21 Glenview St., Greenwich, N.S.W., Australia

***Pittsburgh Branch***

Kenneth Tator, Industrial Lining Engineers, Inc., Sewickley, Pa.

***Chicago Branch***

J. Kronsbein, 513 Deming Pl., Chicago 14, Ill.

N. W. Russell, 331 S. Knight Ave., Park Ridge, Ill.

M. J. Lorenzo, 554 N. Ridgeway Ave., Chicago 24, Ill.

***Jackson-Lansing Branch***

Charles C. Betters, 1101 S. Bowen Ave., Jackson, Mich.

L. R. Burr, 424 N. Grand Ave., Lansing, Mich.

Adelbert E. McRae, Oldsmobile Div., General Motors, Lansing, Mich.

Merle F. Sattler, 307 E. Hillsdale St., Lansing, Mich.

***Baltimore-Washington Branch***

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Orville S. Smith, 2101 Chambrood Rd., Charlotte, N. C.

John F. Simpson, c/o R. H. Bouligny, Inc., 403 Moreland St., Charlotte, N. C.

***Cleveland Branch***

Joseph Gombos, 2523 E. 127th St., Cleveland 20, Ohio

Robert I. Klemm, c/o The McGean Chemical Co., 1106 Republic Bldg., Cleveland, Ohio

Fred G. Benditz, 2417 Tuxedo Ave., Parma 9, Ohio

Norman B. Dewees, 11610 Euclid Ave., Cleveland, Ohio

James Davino, 11712 Angelus Ave., Cleveland 5, Ohio

J. T. Kilbane, C. & B. Sales Co., 4500 Euclid Ave., Cleveland 3, Ohio

Frank MacIntyre, 1279 W. 3rd St., Room 607, Cleveland 13, Ohio

Paul V. Rebel, 3746 Prospect Ave., Cleveland 15, Ohio

Carle E. Nesselroad, 9018 Empire Ave., Cleveland 8, Ohio

***Hartford Branch***

Edward Anderson, Tuttle & Bailey, Inc., New Britain, Conn.

Rocco J. Massaro, 129 Bedford St., Hartford 5, Conn.

Mario McCoia, 171 Gilman St., Hartford 6, Conn.

Harold Knocker, 68 11th St., Orange Grove, Johannesburg, South Africa

H. C. Schlaupitz, The Napier Co., Meriden, Conn.

***Milwaukee Branch***

Fred L. Anderson, 408 S. 75th St., Milwaukee, Wis.

Sylvester Borucki, 279 E. Gauer Circle, Milwaukee, Wis.

William de Check, 3431 8th Ave., Racine, Wis.

Harvey C. Schultz, 3440 N. Booth St., Milwaukee, Wis.

***Philadelphia Branch***

Frank P. King, 430 Chestnut St., Lansdale, Pa.

***Boston Branch***

John W. Ramsden, 65 Beverly St., No. Andover, Mass.

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R. C. Koch, 2320½ Johnston St., Los Angeles, Calif.

John M. Bowman, 3255 Overland Ave., Los Angeles, Calif.

Andrew J. Ospring, 1322 N. Ontario, Burbank, Calif.

Joseph D. Taylor, 2335 E. 52nd St., Los Angeles, Calif.

J. A. Powell, 3209 Humbolt St., Los Angeles 31, Calif.

Ray M. Groom, Avalon Plating Co., 8121 Compton Ave., Los Angeles, Calif.

John C. Mayer, 139 E. 65th St., Los Angeles, Calif.

Paul O. Franke, 1268 W. 87th St., Los Angeles, Calif.

Joseph H. LaVoy, 6352 Riverton Ave., No. Hollywood, Calif.

Loeb Hinderer, 3011 Humbolt Ave., Los Angeles, Calif.

***Dayton Branch***

Earl L. Geiger, 223 S. Ludlow St., Dayton, Ohio

Kenneth C. Brown, 1771 Springfield St., Dayton 3, Ohio

Clifford H. Speck, 523 S. Market St., Troy, Ohio

Arthur H. Horst, 2438 Catalpa Dr., Dayton 6, Ohio

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John C. Rowe, 160 W. 6th St., St. Paul, Minn.

Fred J. Kaim, 1474 Almond Ave., St. Paul, Minn.

E. W. Presser, 1025 Margaret St., St. Paul, Minn.

Werner M. Greenwood, 511 S. 3rd St., Minneapolis, Minn.

H. E. Dimick, 4948 30th Ave., S. Minneapolis, Minn.

***Bridgeport Branch***

Joseph P. Smith, 157 S. Main St., So. Norwalk, Conn.

***Syracuse Branch***

Charles G. Granger, 349 W. Ostander Ave., Syracuse, N. Y.

***Buffalo Branch***

Richard B. Thompson, 820 Elmwood Ave., Buffalo 9, N. Y.

Henry G. Wall, 128 Westminster, Buffalo, N. Y.

***San Francisco Branch***

Boris P. Milo, 2255 Bush St., San Francisco, Calif.

L. S. Mocker, 706 Walla Vista, Oakland 10, Calif.

***Grand Rapids Branch***

Gerald L. Dutmers, 351 James Ave., S. E., Grand Rapids 7, Mich.

Victor A. Partz, R.F.D. No. 4, Owosso, Mich.

H. Jay Walcott, 138 Lincoln Ave., Zeeland, Mich.

Edward W. Gross, 902 Cherry St., S. E., Grand Rapids 6, Mich.

Walter F. Hamacher, 400 Marietta St., N. E., Grand Rapids, Mich.

Carl F. Wallgren, 1634 Giddings Ave., S. E., Grand Rapids, Mich.

Maurice B. Williams, Grand Haven Brass Foundry, Grand Haven, Mich.

***Detroit Branch***

Donald Brockway, 2540 Morrell, Detroit, Mich.

Robert M. Buckingham, 8900 Hubbell, Detroit, Mich.

John D. Collins, 8331 Ellsworth, Detroit 21, Mich.

William G. Crawford, 801 W. Larned, Detroit 26, Mich.

Paul B. Croly, 79 Inches Ave., Chatham,

Ontario, Canada

Don Dattero, 1411 Wayburn, Detroit 30, Mich.

Anthony Dorazio, 34 Liberty St., Pontiac, Mich.

Fred M. Ellis, 17140 Shaftsbury Rd., Detroit 19, Mich.

Edwin M. Graham, 2114 Mountain Ave., Flint 3, Mich.

Wm. Greene, 21201 Audette, Dearborn, Mich.

Edwin W. Hoover, 1651 E. Grand Blvd., Detroit 11, Mich.

Donald C. Hulse, 5845 Orchard, Dearborn, Mich.

Wm. T. Kulezak, 2280 Lyman, Detroit 11, Mich.

Charles H. Marcotte, c/o Wallace J. Ivers Co., 653 DuBois St., Detroit 7, Mich.

Morell Marean, 1224 Maccabees Bldg., Detroit 2, Mich.

Roger Piazza, 11327 Belleterre, Detroit 4, Mich.

Harvey S. Rudesill, 2-142 General Motors Bldg., Detroit 2, Mich.

E. Guy Sanders, 55 Lafayette, Pontiac, Mich.

Sandro A. Saporta, 1590 W. Grand Blvd., Detroit 11, Mich.

D. Thomas Stanton, Jr., P.O. Box 2803, Detroit 31, Mich.

Wm. Kenneth Sticksel, 5399 Spokane Ave., Detroit 4, Mich.

Arthur A. Subject, 26905 Notre Dame, Inkster, Mich.

George I. Thompson, 14037 Coyle, Detroit 27, Mich.

Sylvester Thum, 55 Lafayette, Pontiac, Mich.

Alex Tymkow, 3109 E. Davison, Detroit 12, Mich.

Edward S. Witthoff, 14227 Promenade, Detroit 5, Mich.

George R. Young, 1419 Cambridge, Berkley, Mich.

Manley E. Young, Art Metal Platers, 61 Short St., Pontiac, Mich.

## APPLICATIONS

***Pittsburgh Branch***

Morton Schwartz, 467 Cypress Dr., Coraopolis, Pa.

George Canaga, 804 Fulton Bldg., Pittsburgh 22, Pa.

W. B. Williams, 37 St. Clair Dr., Pittsburgh 16, Pa.

***Chicago Branch***

C. A. Crowley, 407 S. Dearborn St., Chicago 5, Ill.

S. Skinner, 1020 Lawrence Ave., Chicago 40, Ill.

D. A. Morrison, 1501 W. Polk St., Chicago 7, Ill.

R. C. Davis, 1429 E. Marquette Rd., Chicago 7, Ill.

R. A. Tank, 1200 W. Harrison St., Chicago 7, Ill.

T. M. Witte, 321 N. Pulaski Rd., Chicago 24, Ill.

J. J. Lamb, 800 N. Clark St., Chicago 10, Ill.

***Hartford Branch***

Lester F. Spencer, Landers, Frary & Clark, 23 Center St., New Britain, Conn.

***Baltimore-Washington Branch***

Carl A. Zapffe, 6410 Murray Hill Rd., Baltimore 12, Md.

***Milwaukee Branch***

Leslie Diveley

Frank W. Gutman

Russell Rothe

***Philadelphia Branch***

James S. Todd

L. C. Hamilton

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George H. Darling, 21 Fairview Ave., Reading, Mass.

Eugene P. Carter, 30 Bond St., Somerville 43, Mass.

George F. Melanson, 6 Jersey St., Boston 15, Mass.

Michael A. Rizzo, 82 Proctor Ave., Revere 51, Mass.

***Los Angeles Branch***

Fred Rabago

Walter Kelin

LeRoy Christensen

Adolph Janke

***New York Branch***

Paul R. Cutter, 115 Broad St., Matawan, N. J.

***Bridgeport Branch***

Joseph P. Smith, 157 S. Main St., So. Norwalk, Conn.

***Cleveland Branch***

Clayton D. McConkey, 12026 Clifton Blvd., Lakewood 7, Ohio

Walter E. Taves, Chromium Corp. of America, 1760 Lakeview Rd., Cleveland 12, Ohio

John J. Tyner, c/o Wyandotte Chemical Corp., 1102 Midland Bldg., Cleveland, Ohio

***Springfield Branch***

Peter J. Balick, 207 Green St., Clinton, Mass.

***Dayton Branch***

Marion Studebaker, 18 S. Oxford St., Troy, Ohio

***Bridgeport Branch***

Joseph G. Lucas, 2994 Main St., Stratford, Conn.

Howard B. Seeley, 2136 Huntington Turnpike, Nichols 18, Conn.

***Newark Branch***

John M. Guthrie, 590 Clinton Ave., Newark 8, N. J.

### TRANSFERS

W. C. Bryan from Chicago Branch to Hartford Branch

V. Mattacotti from Chicago Branch to Milwaukee Branch

E. Stenberg from Milwaukee Branch to Chicago Branch

Chester Borlet from Buffalo Branch to Detroit Branch

H. E. Mosser from Toledo Branch to Detroit Branch

R. H. McCahan from Bridgeport Branch to Hartford Branch

Joseph Kleinman from Bridgeport Branch to New York Branch

Frederick C. Strong from Hartford Branch to Philadelphia Branch

Frank Serot from San Francisco Branch to Los Angeles Branch

Lawrence J. Durney from Pittsburgh Branch to Bridgeport Branch

### REINSTATEMENTS

***Pittsburgh Branch***

N. H. McKay, 1100 Pitts St., Pittsburgh 21, Pa.

***Detroit Branch***

E. Tawyea, 16745 Burgess, Detroit 19, Mich.

***Hartford Branch***

Frank Carmella, The Clayton Mfg. Co., Bristol, Conn.

### RESIGNATIONS

***Chicago Branch***

F. P. Heller

***Detroit Branch***

Stanley Skinner

E. L. McIlhenny

R. H. Clemmons

***Milwaukee Branch***

A. L. Edelman

***Dayton Branch***

William Brandt

***Grand Rapids Branch***

Wilbur A. Hallberg

Benjamin S. Flug

Bernard Groth

William T. Darling

Charles D. Wilson

Clarence Robison

***Twin City Branch***

L. P. Guimont

L. R. Goodlund

### SUSPENSIONS

***Buffalo Branch***

H. B. Smith

W. J. Walsh

J. N. Wood

I. R. Gage

R. Hubner

C. J. Menzemer

R. O'Grady

***Twin City Branch***

William J. Hansen

T. P. Daufelt

Frank Dugal

### DEATHS

***Toledo Branch***

Henry Schuldt

***Philadelphia Branch***

Phillip Uhl

## Phillip Uhl Passes Away

Phillip Uhl, an honorary member of the A.E.S. and of its Philadelphia Branch, passed away at his home in Philadelphia on November 19. The burial took place on the 23rd.

The A.E.S. sent a spray of flowers with an accompanying card reading "To a Valued Friend and Honorary Member."

## William S. Felton Dies

William Scott Felton, General Manager of the Missouri Plating and Finishing Company, Kansas City, Mo., died on September 12, 1945. Mr. Felton served in the Chemical Warfare Service during 1917-18 and did consulting work for a number of armament firms during World War II.

He is survived by his wife, Ruth Barbara Felton, a brother Harold and parents in Philadelphia.

# MEMBERSHIP CHART

| BRANCH | May 1945 | Change in Membership | Percent Change |
|---|---|---|---|
| **FIRST GROUP** | | | |
| CLEVELAND | 143 | +16 | +11.2 |
| LOS ANGELES | 151 | +15½ | +10.3 |
| DETROIT | 390 | +37½ | + 9.6 |
| PHILADELPHIA | 154 | +10 | + 6.5 |
| NEWARK | 213 | +12 | + 5.6 |
| CHICAGO | 357 | +17 | + 4.8 |
| BALTIMORE-WASH. | 122 | + 4½ | + 3.7 |
| NEW YORK | 191 | + 7 | + 3.7 |
| WATERBURY | 122 | + 3½ | + 2.9 |
| GRAND RAPIDS | 121 | + 2½ | + 2.1 |
| BOSTON | 157 | + 2½ | + 1.6 |
| HARTFORD | 126 | + ½ | + 0.4 |
| **SECOND GROUP** | | | |
| PROV.-ATTLEBORO | 101 | + 6½ | + 6.4 |
| BRIDGEPORT | 118 | + 6½ | + 5.5 |
| ROCHESTER | 90 | + 4½ | + 5.0 |
| PITTSBURGH | 80 | + 4 | + 5.0 |
| MILWAUKEE | 107 | + 2½ | + 2.3 |
| INDIANAPOLIS | 112 | + 1 | + 0.9 |
| SPRINGFIELD | 73 | + ½ | + 0.7 |
| ST. LOUIS | 116 | — | — |
| NEW HAVEN | 106 | — ½ | — 0.5 |
| TORONTO | 119 | — 2 | — 1.7 |
| DAYTON | 109 | — 3 | — 2.7 |
| BUFFALO | 89 | — 4½ | — 5.1 |
| **THIRD GROUP** | | | |
| ROCKFORD | 23 | +15 | +65.2 |
| SYDNEY | 51 | +31 | +60.8 |
| TWIN CITY | 52 | +13½ | +26.0 |
| SAN FRANCISCO | 55 | +11 | +20.0 |
| TOLEDO | 54 | + 6½ | +12.0 |
| JACKSON-LANSING | 62 | + 7 | +11.3 |
| SYRACUSE | 57 | + 6 | +10.5 |
| LANCASTER | 39 | + 1½ | + 3.8 |
| MONTREAL | 54 | — | — |
| CINCINNATI | 57 | — | — |

Membership May 1, 1945 = 3972
Membership Dec. 1, 1945 = 4256

Gain in Membership = 284
Per Cent of Gain = 7.2

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Her "paint" has been on for only a few hours and yet she's having trouble removing it. In contrast, the coatings of paint that you run into may have been on for many years. To get them off, you must use efficient stripping compounds — materials that dig in and get right down to the surface of the bare metal.

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# Just a little shaver

BUT is his beard tough!

The case is often the same with cleaning metals—a small job may be hard to handle.

With most jobs it makes no difference, though, whether the work is big or little, simple or involved — if you use Wyandotte Metal Cleaners. There's one of these *specialized* degreasing compounds to fill just about any metal-cleaning need — for cleaning after machining and prior to plating, painting, lacquering, blackening, anodizing, spot welding . . .

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**J. B. FORD DIVISION • Wyandotte, Michigan**
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## THE *Ideal* PRODUCTION FINISH

★ For that *better* product that will stand up and really *sell* in today's competitive markets—it's **DURANITE!**

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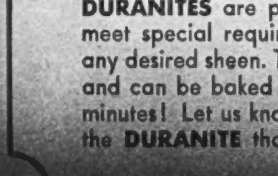
★ **DURANITE** is really "tops" for finishing refrigerators, ironers, stoves and countless other metal products. Best of all, it's now available **in quantity!**

**DURANITES** are plastic-base finishes made in various grades to meet special requirements—come in whites, clear, colors and in any desired sheen. They may be applied by spray, dip or roller-coat and can be baked with infra-red or convection heat. They cure in minutes! Let us know your finish problems and we will recommend the **DURANITE** that will solve them.

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**Third Vice-President** - - - - - - - - - - - **K. M. HUSTON**
3208 Tyndale Avenue, Baltimore, Md.
**Past President** - - - - - - - - - - - - - **M. R. CALDWELL**
Doehler-Jarvis Corp., 1501 Paris Ave., S.E., Grand Rapids 2, Mich.
**Executive Secretary** - - - - - - - - - - - - **A. K. GRAHAM**
P.O. Box 168, Jenkintown, Pa.

**ADELAIDE, AUSTRALIA.** Act. Sec., G. N. Dixon, G.P.O. Box 428D, Adelaide, Australia.

**BALTIMORE-WASHINGTON** meets first Tuesday of each month, in Oct., Dec., Feb., & April at the Engineers' Club, Baltimore, Md., and in Nov., Jan., March & May at Kenesaw Apts., Washington, D. C. Secretary-Treasurer, Albert G. Taylor, 1209 E. 25th St., Baltimore 14, Md.

**BOSTON** meets first Thursday each month at Hotel Statler, Boston, Mass. Secretary, A. W. Garrett, 35 Rosemont St., Dorchester, Mass.

**BRIDGEPORT** meets first and third Friday of each month at Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony St., Bridgeport 8, Conn.

**BUFFALO** meets second Friday of each month at Hotel Statler, Buffalo, N. Y. Secretary, J. A. Kushner, 316 Winslow Ave., Buffalo, N. Y.

**CHICAGO** meets second Friday of each month at 8 p.m., Hamilton Hotel, 18 S. Dearborn St. Secretary, M. H. Longfield, 1528 South 61 St., Cicero 50, Ill.

**CINCINNATI** meets on fourth Thursday of each month at 8 p.m., at the Engineering Society Headquarters, Mc Millan St. and Woodburn Avenue, Cincinnati, Ohio. Secretary-Treasurer, Elliott W. Horning, 2425 Kenilworth Ave., Norwood 12, Ohio.

**CLEVELAND** meets first Saturday of each month at Cleveland Hotel. Secretary-Treasurer, Harvey P. Heil, 12901 Elmwood Ave., Cleveland 11, Ohio.

**COLUMBUS** meets last Friday of each month at the Battelle Memorial Institute Auditorium, 505 King Avenue, Columbus 1, Ohio at 8:00 p.m. Secretary, David S. Stoker, 1338 Meadow Road, Columbus 8, Ohio.

**DAYTON** meets second Friday of each month at the Engineers Club, Dayton, Ohio. Secretary-Treasurer, Ralph L. Clinefelter, West Milton, Ohio.

**DETROIT** meets the first Friday of each month at the Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich.

**GRAND RAPIDS** meets second Friday of each month, 7:30 p.m., at the Rowe Hotel. Secretary, R. Perkins, 916 Fairmount St., S.E., Grand Rapids 6, Mich.

**HARTFORD** meets third Monday of each month at Hotel Garde, Hartford, Conn. Secretary, F. W. Smith, 46 Cottage St., Meriden, Conn.

**INDIANAPOLIS** meets first Wednesday of each month at Hotel Riley. Secretary-Treasurer, Quenton Shockley, 4952 W. 12th St., Indianapolis, Ind.

**JACKSON-LANSING** meets second Tuesday of each month alternating between Home Dairy at Lansing and Hotel Hayes at Jackson. Secretary-Treasurer, R. E. Brown, 3851 Dobie Rd., Okemos, Mich.

**LANCASTER** meets second Friday of each month at 8 p.m., at Thaddeus Stevens Industrial School, Lancaster, Pa. Secretary-Treasurer, W. H. Fordney, 603 Marietta Ave., Lancaster, Pa.

**LOS ANGELES** meets second Monday of each month, 6:30 p.m. at the Rosslyn Hotel, corner Fifth and Main

(*Continued on next page*)

# BRANCH DIRECTORY

(*Continued from preceding page*)

Sts. Secretary-Treasurer, Frank Bunker, 2030 Bay St., Los Angeles, Calif.

**MELBOURNE, AUSTRALIA.** Secretary, M. R. J. Andrews, 21 Argo St., S. Yarra, SE1, Melbourne, Australia.

**MILWAUKEE** meets first Friday of each month at the Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, James Durnford, 2370 N. 32nd St., Milwaukee 10, Wis.

**MONTREAL** meets first Monday of each month at Mount Royal Hotel, Montreal, Quebec, Canada. Secretary-Treasurer, Estelle Gravel, 267 Demarchais Blvd., Verdun, Quebec, Can.

**NEWARK** meets first and third Friday of each month at Hotel Robert Treat, Newark, N. J., at 8 p.m. Secretary-Treasurer, George Wagner, 1130 So. Long Ave., Hillside, N. J.

**NEW HAVEN** meets first Tuesday of each month at Sterling Chemistry Laboratory, Yale University. Secretary-Treasurer, B. J. Gaffney, 40 Filbert St., Spring Glen, Hamden 14, Conn.

**NEW YORK** meets second and fourth Fridays of each month, in the Hotel Pennsylvania, 7th Ave. and 33rd St., New York City, N. Y. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton St., Garden City, L. I., N. Y.

**PHILADELPHIA** meets fourth Friday of each month, in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, Paul Mentzer, Sr., 7242 Bingham St., Philadelphia 11, Pa.

**PITTSBURGH** meets third Thursday of each month at 6:30 p.m. at the Roosevelt Hotel, Pittsburgh, Pa. Secretary-Treasurer, Frank Keller, 1102 Hiland Ave., Coraopolis, Pa.

**PROVIDENCE-ATTLEBORO** meets the third Monday of each month at the Providence-Baltimore Hotel. Secretary-Treasurer, Chas. C. Chace, 11 Friendly Road, Cranston 10, Rhode Island.

**ROCKFORD.** Secretary, Stuart Golding, 205 Washington St., Rockford, Ill.

**ROCHESTER** meets third Friday of each month at the Hotel Seneca, Rochester, N. Y. Secretary-Treasurer, Donald C. Blum, 672 Mt. Read Blvd., Rochester, N. Y.

**SAN FRANCISCO** meets the last Thursday of each month, usually at Angelo's, 4307 San Pablo Avenue, Oakland, Calif. Secretary-Treasurer, J. R. Pattenger, 170 Division St., San Francisco 3, Calif.

**SPRINGFIELD** meets the fourth Monday of each month at the Hotel Charles. Secretary-Treasurer, Paul Lyman, Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.

**ST. JOSEPH VALLEY.** Secretary, George Bock, Jr., 177-179 E. Marion St., Elkhart, Indiana.

**ST. LOUIS** meets first Friday of each month at Central Y. M. C. A., 16th and Locust Sts. Secretary-Treasurer, C. T. McGinley, 8319 Garfield, St. Louis County 14, Mo.

**SYDNEY, AUSTRALIA.** Secretary-Treasurer, Lawrence Smith, Box 2064, G.P.O., Sydney, Australia.

**SYRACUSE** meets second Friday of each month at Bowne Hall, Syracuse University, Syracuse, N. Y. Secretary, Neil Maffei, 206 Union Ave., Syracuse 3, N. Y.

**TOLEDO** meets first Thursday of each month at the office of the Vic Miner Co., 329 20th Street, Toledo, Ohio. Secretary, Gaston Bergeman, 703 Pine St., Fremont, Ohio.

**TORONTO** meets second Friday of each month at Royal York Hotel. Secretary, E. P. Blandy, 369 Prince Edward Drive, Toronto 9, Ont., Canada.

**TWIN CITY** meets first Monday of each month, October through June, at the Covered Wagon Cafe, Lodge Room, 114 South 4th St., Minneapolis. Secretary-Treasurer, Robert L. Buckley, 4300 Linden Hills Blvd., Minneapolis 10, Minn.

**WATERBURY** meets second Friday of the month at Elton Hotel. Secretary-Treasurer, Spencer L. Henn, Apothecaries Hall Co., Waterbury 88, Conn.

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### *Protects them from Punishing Plating Cycles*

Compounded of new and improved resins, Unichrome Coating 202 has exceptional chemical resistance, unusual toughness and superior adhesion. Even with high-temperature plating solutions, corrosive anodizing baths and severe cleaning cycles, your racks will enjoy a longer, more useful life when insulated with this coating. This means important hours saved and money in your pocket.

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**Toughness**—Withstands repeated flexing and shop handling—cuts cleanly and easily at contacts.

**Drying**—Dipped at room temperature in container in which it is shipped—force dried at 200°F. for extra protection.

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FIRST: Ten throwing edges assure maximum throwing power—greater all around plating efficiency.

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## LEAD EQUIPMENT CO.

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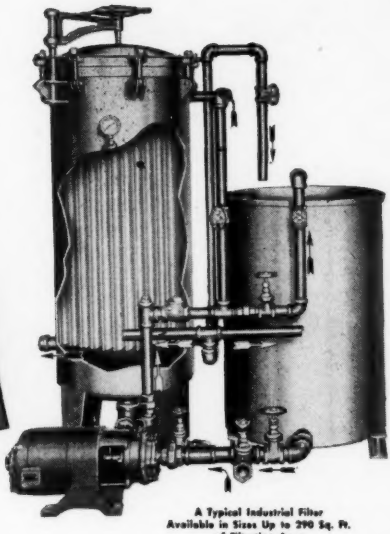
**A Unit of the U. S. Stoneware Co.**



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Available in Sizes Up to 290 Sq. Ft.
of Filtration Area

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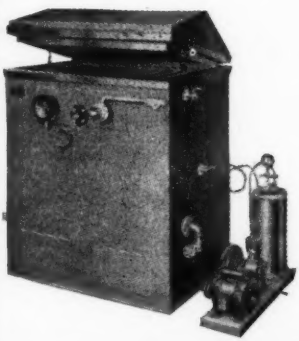

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## *Corrosion Test Equipment*

This modern instrument is designed to meet all requirements of latest "Salt Fog Testing Procedure Specifications" to determine corrosion resistance of plated, coated, lacquered or painted parts.

Serious rejection losses on industrial finishes which must meet Army or Navy specifications are avoided by systematic tests with Industrial Salt Fog Test Equipment.

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**No. 1—48" long 26" wide 36" deep No. 3—30" long 18" wide 30" deep**
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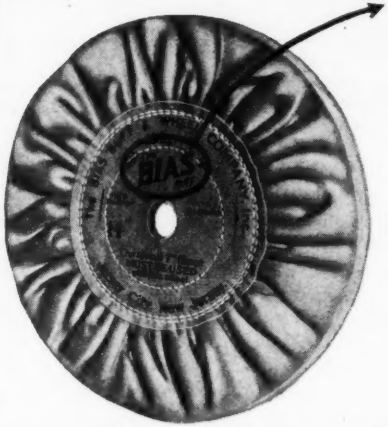


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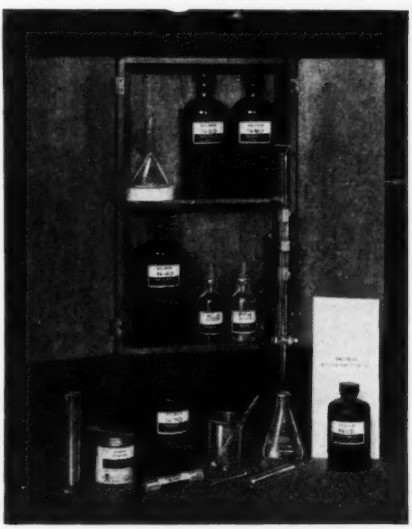

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Simple test sets for aid in controlling plating and other solutions.

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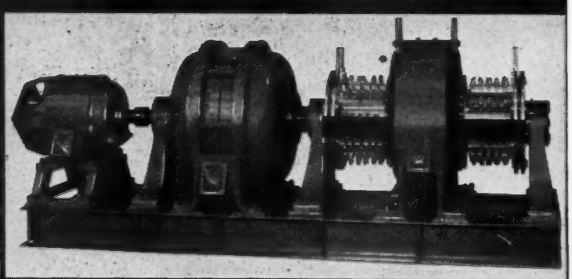

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An experienced engineering staff is maintained at our plant for advising on the best methods of finishing metal products.

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BLACK for STEEL

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War-proven applications of PENTRATE and PX point the way to hundreds of new peace-time uses.

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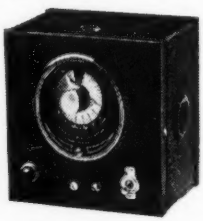
**COMPOUND:**
Burring, Cutting Down, Polishing, Mirror Finishing
**4A CEMENT:**
Used for setting up Wheels, Belts, Buffs & etc.
**HARRISON & COMPANY, INC., Haverhill, Massachusetts**

*on the job for* **TIMING PRECISION**



**SIGNALLING TIMER**

**A new Timer designed to give the highest degree of precision control. The Series 5 Timer will command visual and audible attention the instant a time interval is completed. This Signalling Timer provides for the automatic closing or opening of a circuit at the end of elapsed time. As an indication of the versatility of the Signalling Timer, it will also operate additional buzzers, bells or lights at remote locations.**

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*Rugged construction*
*Compact—*
*5 x 5 x 3½ inches*
*Dial calibration 1 second to 5 minutes*
*Maximum interval 1 minute to 3 hours*
*Motor, slow speed—self-starting*
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